

COP 4710: Database Systems Fall 2008

Introduction To MySQL

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MySQL RDBMS

- MySQL is a **database server** (although it does come with a set of simple client programs). The current stable version is 5.0.67 and can be downloaded from www.mysql.com. (Any of the versions of MySQL 5.0.27 or greater will be fine for our purposes.)
- It is typically used in **thin client** environments. In other words, it is used in client-server systems where the bulk of the processing and storage takes place on the server, and the client is little more than a dumb terminal.
- MySQL performs multithreaded processing, which means that multiple clients are allowed to connect to it and run queries simultaneously. This makes MySQL extremely fast and well suited to client-server environments such as Web sites and other environments that process numerous transactions for multiple users.



MySQL :: The world's most popular open source database - Windows Internet Explorer

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<p>My own method of keeping my systems up to date and am comfortable upgrading and configuring MySQL.</p>	<p>Automated notifications and predictable releases of well-tested updates and upgrades.</p>
<p>Time to monitor and adjust the MySQL settings that will tune, scale and maintain performance.</p>	<p>Proactive, visual notification and advice on maintaining optimal performance.</p>
<p>Experience with database security so that I know when a security breach has occurred.</p>	<p>Continuous monitoring of systems so that I can be alerted to unplanned security changes and vulnerabilities.</p>

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This should be the next page you see.
Click this option to go to MySQL
Community Server page.



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http://dev.mysql.com/downloads/mysql/5.0.html

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My own method of keeping my systems up to date and am comfortable upgrading and configuring MySQL.	Automated notifications and predictable releases of well-tested updates and upgrades.
Time to monitor and adjust the MySQL settings that will tune, scale and maintain performance.	Proactive, maintaining optimal performance.
Experience with database security so that I know when a security breach has occurred.	Continuous monitoring of systems so that I can be alerted to unplanned security changes and vulnerabilities.
Experience designing, setting-up and	Replication status monitoring so that I can

Click here to download MySQL 5.0



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http://dev.mysql.com/downloads/mysql/5.0.html

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- The **Debug** binaries have been compiled for production use, because the included debugging code may reduce performance.

View the MySQL 5.0 List of Changes

We suggest that you use the MD5 checksums and GnuPG signatures to verify the integrity of the packages you download.

Note: It is good practice to back up your data before installing any new version of software. Although MySQL has done its best to ensure a high level of quality, you should protect your data by making a backup. MySQL generally recommends that you dump and reload your tables from any previous version to upgrade to 5.0.

- Windows
- Windows x64
- Linux (non RPM packages)
- Linux (non RPM, Intel C/C++ compiled, glibc-2.3)
- Red Hat Enterprise Linux 3 RPM (x86)
- Red Hat Enterprise Linux 3 RPM (AMD64 / Intel EM64T)
- Red Hat Enterprise Linux 3 RPM (Intel IA64)
- Red Hat Enterprise Linux 4 RPM (x86)
- Red Hat Enterprise Linux 4 RPM (AMD64 / Intel EM64T)

Done Internet 100%

Scroll down this page and select the proper platform for your system.



MySQL :: MySQL 5.0 Downloads - Windows Internet Explorer

http://dev.mysql.com/downloads/mysql/5.0.html#win32

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MySQL :: MySQL 5.0 Downloads

Windows downloads (platform notes)

Windows Essentials (x86)	5.0.67	23.3M	Download Pick a mirror
MD5: 6001ae41e1031e770c2cb576a4562e65 Signature			
Windows ZIP/Setup.EXE (x86)	5.0.67	45.3M	Download Pick a mirror
MD5: ed76e5ad8b251ca643766c70926854d7 Signature			
Without installer (unzip in C:\)	5.0.67	63.1M	Download Pick a mirror
MD5: aed74f2a9432e114d965ae52e5f38689 Signature			

Windows x64 downloads (platform notes)

Windows Essentials (AMD64 / Intel EM64T)	5.0.67	27.4M	Download Pick a mirror
MD5: 28eaac91673d23d0f367f413565bb7fb Signature			
Windows ZIP/Setup.EXE (AMD64 / Intel EM64T)	5.0.67	52.8M	Download Pick a mirror
MD5: 16f88ff572154f64e84226fc1c42c3a9 Signature			
Without installer (AMD64 / Intel EM64T)	5.0.67	74.9M	Download Pick a mirror
MD5: 50545341e2b031550000000000000000 Signature			

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- My own method of keeping my systems up to date and am comfortable upgrading and configuring MySQL.
- Time to monitor and adjust the MySQL settings that will tune, scale and maintain performance.
- Experience with database security so that I know when a security breach has occurred.

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- Automated notifications and predictable releases of well-tested updates and upgrades.**
- Proactive, visual notification and advice on maintaining optimal performance.**
- Continuous monitoring of systems so that I can be alerted to unplanned security changes and vulnerabilities.**

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Go back to the main download page and also download MySQL Administrator and MySQL Query Browser available from the GUI Tools option.



MySQL :: MySQL GUI Tools Downloads - Windows Internet Explorer

http://dev.mysql.com/downloads/gui-tools/5.0.html

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MySQL GUI Tools Downloads

This is the MySQL GUI Tools Bundle for 5.0. It includes the following products.

- MySQL Administrator 1.2 [Generally Available \(GA\)](#)
- MySQL Query Browser 1.2 [Generally Available \(GA\)](#)
- MySQL Migration Toolkit 1.1 [Generally Available \(GA\)](#)

Windows downloads

The install package uses the Windows Installer, which is built in to Windows XP and more recent Microsoft Windows versions. [An update for Windows 2000 can be downloaded here.](#)

Windows (x86)	5.0-r12	17.4M	Pick a mirror
---------------	---------	-------	-------------------------------

The Query Browser and Administrator come in a bundle with some other tools. Scroll down and select the correct option for your machine.



Installing MySQL 5.0.67

- Once you've got MySQL downloaded, go through the installation process. It may vary somewhat depending on platform.
- I've illustrated the basic install on Windows XP over the next few pages, just to give you an idea of what you should be seeing.



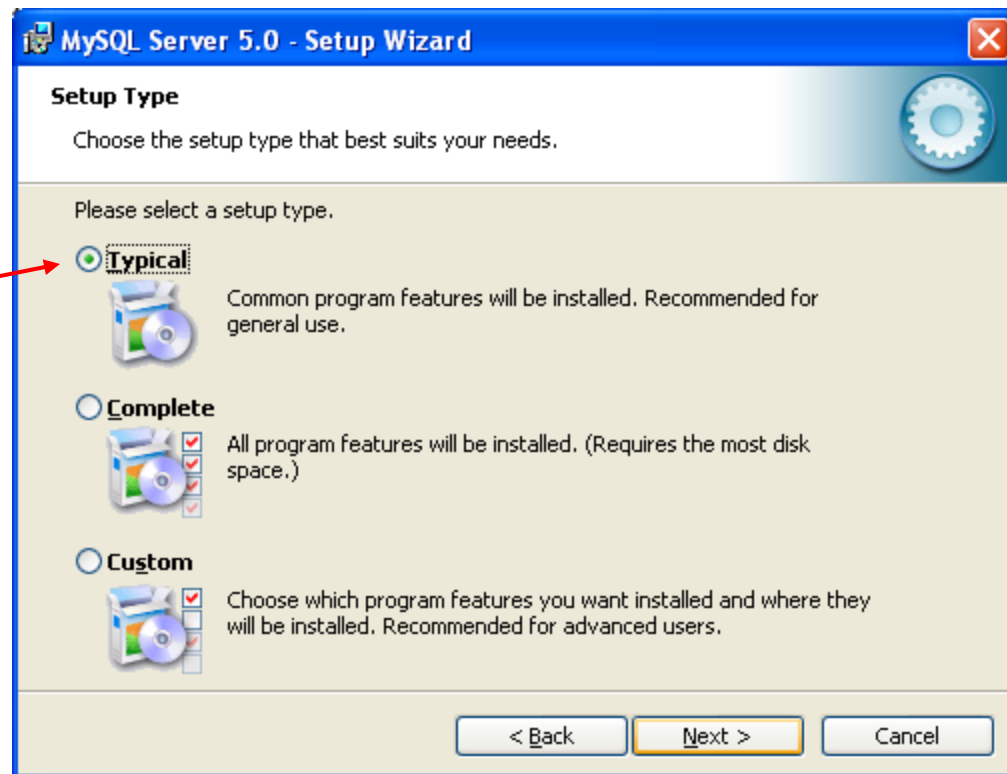
Installing MySQL 5.0.67

- Once you've got MySQL downloaded, go through the installation process. It may vary somewhat depending on platform.
- I've illustrated the basic install on Windows XP over the next few pages, just to give you an idea of what you should be seeing.
- Once the Windows installer is running you should see the following window appear:

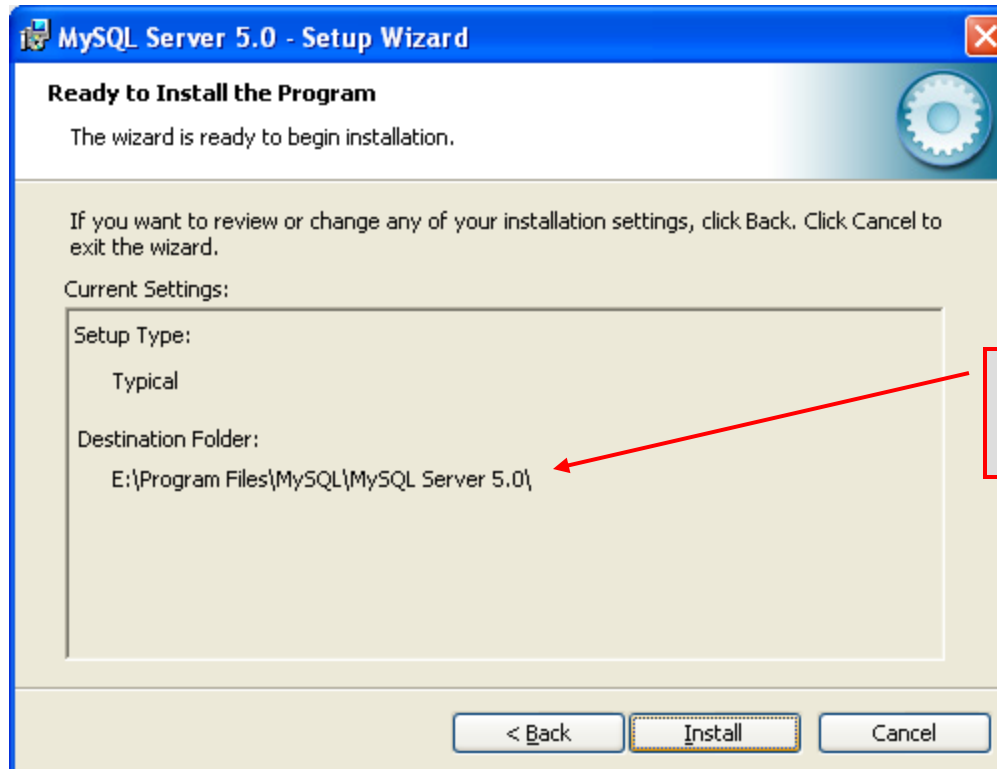


Installing MySQL 5.0 (cont.)

Your choice here.
For this course, a
typical set-up will be
fine.



Installing MySQL 5.0 (cont.)

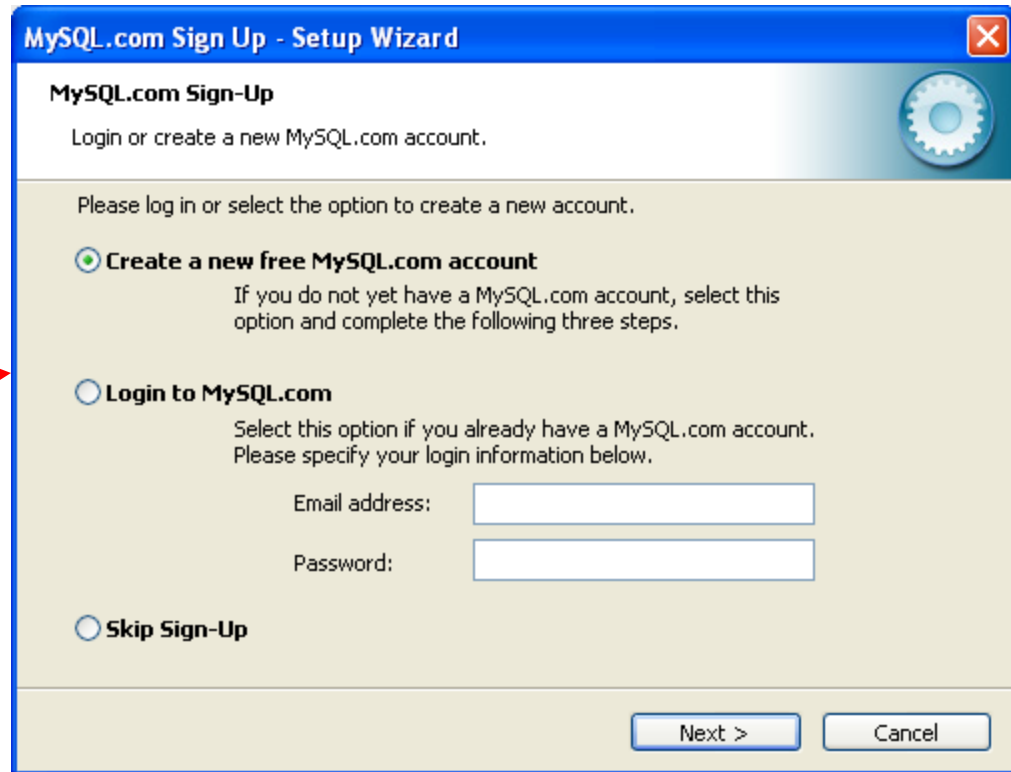


Select the destination folder for the install.



Installing MySQL 5.0 (cont.)

Again, your choice here. If you want to skip the sign-up that's fine.



The image shows a Windows-style dialog box titled "MySQL.com Sign Up - Setup Wizard". It has a blue title bar with a close button (X) in the top right corner. The main content area is light beige and contains the following text: "MySQL.com Sign-Up", "Login or create a new MySQL.com account.", and "Please log in or select the option to create a new account." There are three radio button options: "Create a new free MySQL.com account" (which is selected), "Login to MySQL.com", and "Skip Sign-Up". The "Login to MySQL.com" option has subtext: "Select this option if you already have a MySQL.com account. Please specify your login information below." Below this subtext are two input fields labeled "Email address:" and "Password:". At the bottom right of the dialog are two buttons: "Next >" and "Cancel". A red arrow points from the text box on the left to the "Skip Sign-Up" radio button.

MySQL.com Sign Up - Setup Wizard

MySQL.com Sign-Up

Login or create a new MySQL.com account.

Please log in or select the option to create a new account.

☒ **Create a new free MySQL.com account**
If you do not yet have a MySQL.com account, select this option and complete the following three steps.

☐ **Login to MySQL.com**
Select this option if you already have a MySQL.com account. Please specify your login information below.

Email address:

Password:

☐ **Skip Sign-Up**

Next > Cancel



Installing MySQL 5.0 (cont.)



If everything has good well up to this point, you should see a window similar to this one. Click the Finish button, cross your fingers, and hang-on while the installer configures your system and gets MySQL up and running as a service.



Installing MySQL 5.0 (cont.)

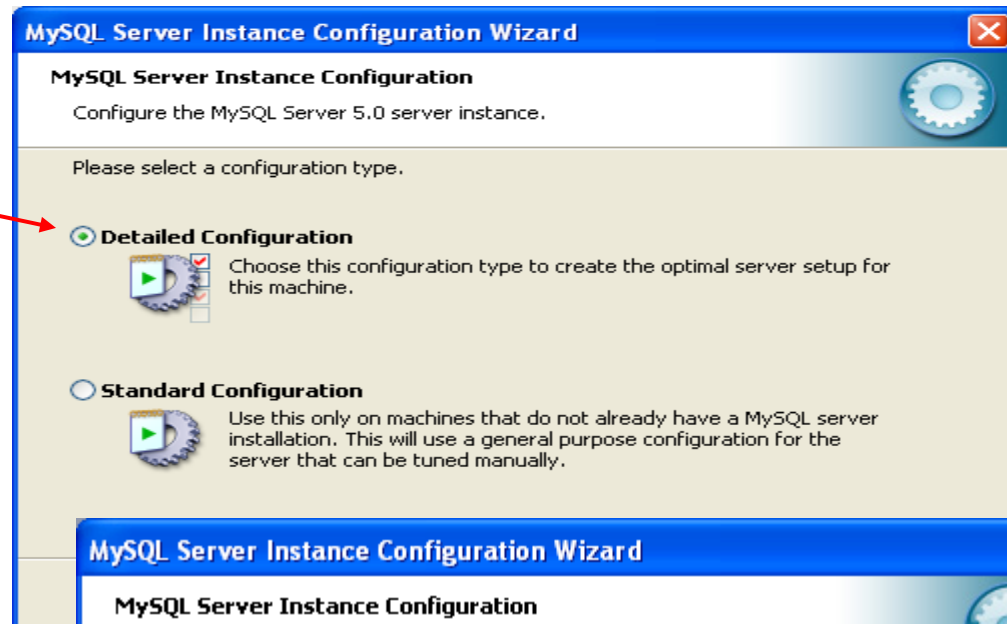
Initial server
configuration window



Installing MySQL 5.0 (cont.)

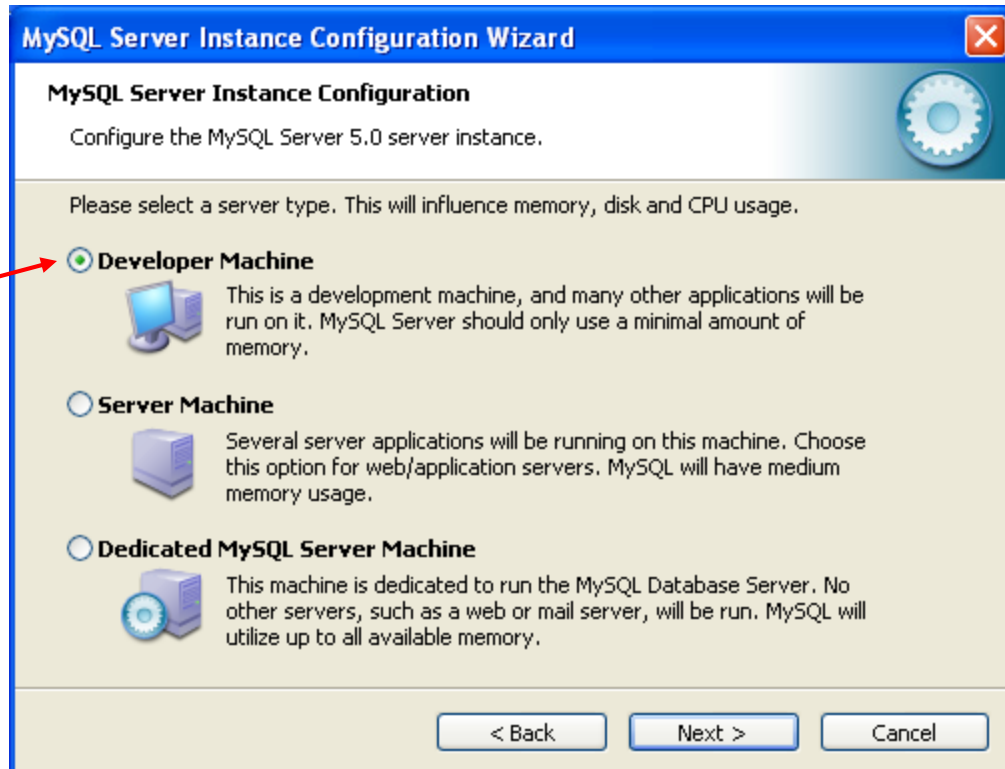
Your choice here. If you are not sure if there is already a MySQL server on your machine, choose the detailed configuration setting.

If you already have an instance of a MySQL server on your machine, you'll see this screen first, followed by the one above. Select reconfigure instance.



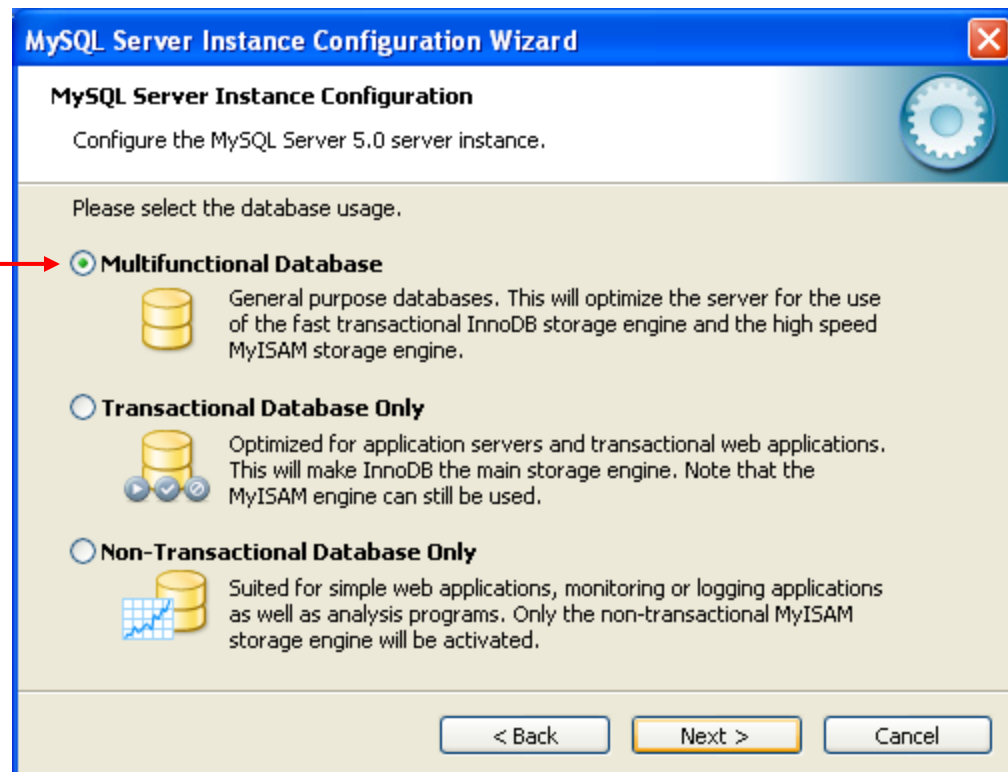
Installing MySQL 5.0 (cont.)

Choose the
developer machine
option



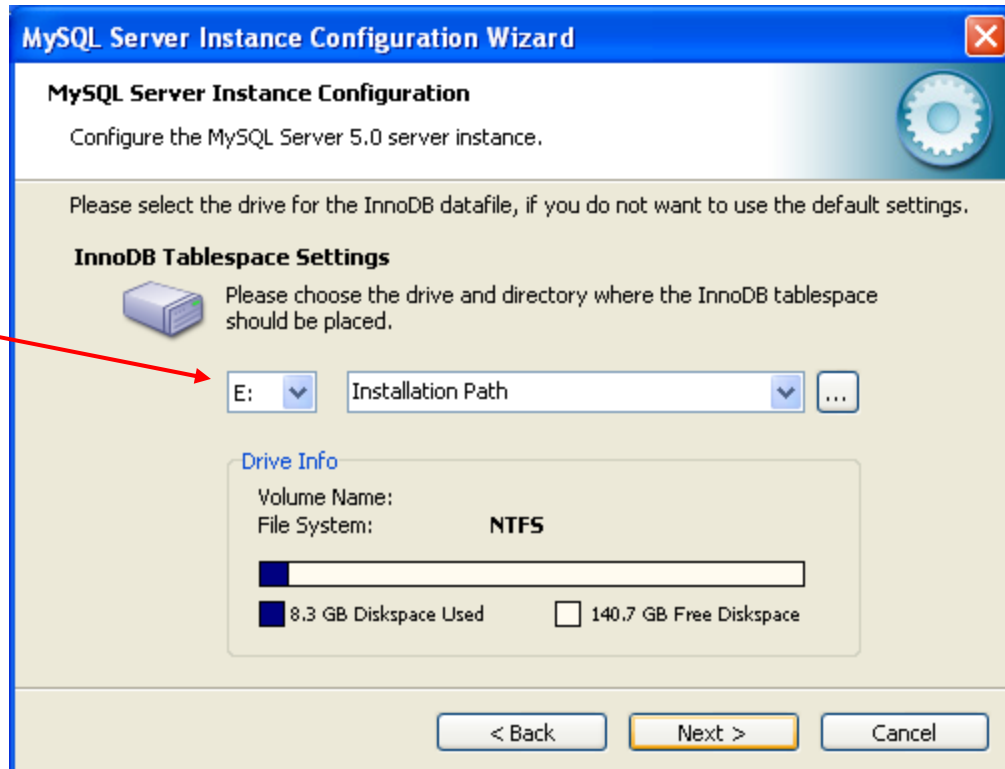
Installing MySQL 5.0 (cont.)

Choose the
multifunctional
database option



Installing MySQL 5.0 (cont.)

Choose the installation path to keep InnoDB tables in same area as other MySQL files

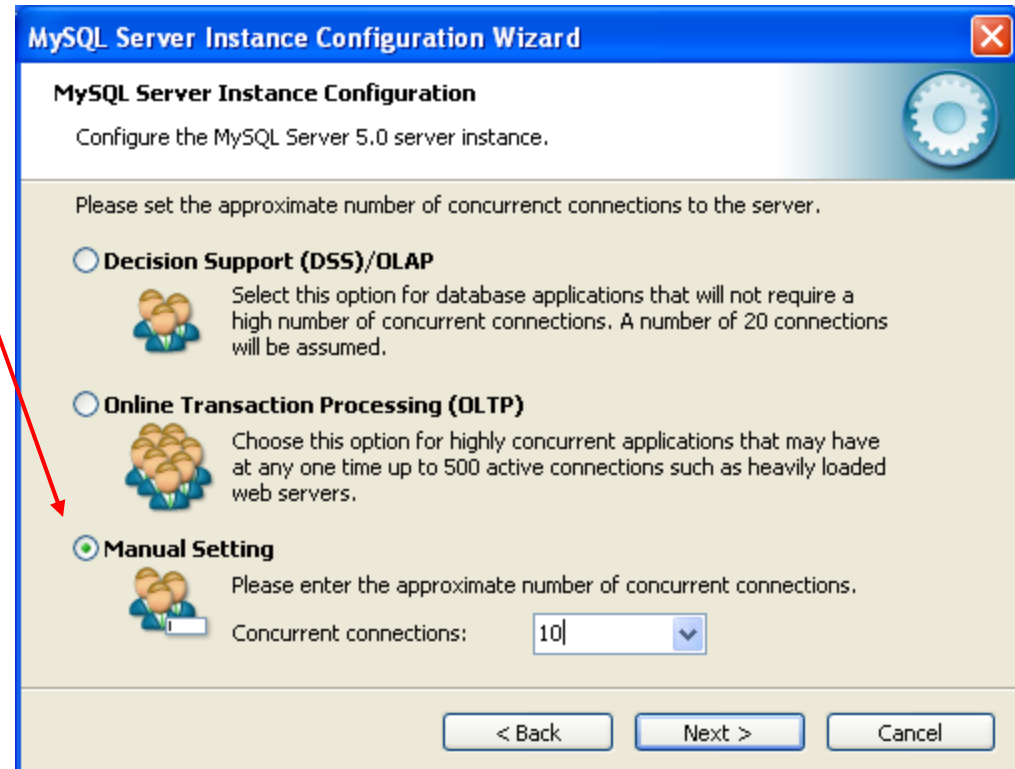


The screenshot shows the 'MySQL Server Instance Configuration Wizard' window. The title bar reads 'MySQL Server Instance Configuration Wizard'. The main heading is 'MySQL Server Instance Configuration', with a subtitle 'Configure the MySQL Server 5.0 server instance.' Below this, a message says 'Please select the drive for the InnoDB datafile, if you do not want to use the default settings.' The section is titled 'InnoDB Tablespace Settings' and includes a hard drive icon. The text says 'Please choose the drive and directory where the InnoDB tablespace should be placed.' There is a dropdown menu showing 'E:' and a text box containing 'Installation Path'. Below this is a 'Drive Info' section showing 'Volume Name:' and 'File System: NTFS'. A progress bar indicates '8.3 GB Diskpace Used' and '140.7 GB Free Diskpace'. At the bottom are buttons for '< Back', 'Next >', and 'Cancel'. A red arrow points from the text box on the left to the 'E:' dropdown menu.



Installing MySQL 5.0 (cont.)

Select manual setting for this option. The default is 15, I set mine to 10, but you can use any number you would like, but pick something greater than 2 or 3.



The image shows the 'MySQL Server Instance Configuration Wizard' window. The title bar reads 'MySQL Server Instance Configuration Wizard'. The main heading is 'MySQL Server Instance Configuration' with a subtext 'Configure the MySQL Server 5.0 server instance.' Below this, it says 'Please set the approximate number of concurrent connections to the server.' There are three radio button options: 'Decision Support (DSS)/OLAP', 'Online Transaction Processing (OLTP)', and 'Manual Setting'. The 'Manual Setting' option is selected. Below 'Manual Setting', it says 'Please enter the approximate number of concurrent connections.' and 'Concurrent connections: 10'. At the bottom, there are three buttons: '< Back', 'Next >', and 'Cancel'. A red arrow points from the text box on the left to the 'Manual Setting' radio button.

MySQL Server Instance Configuration Wizard

MySQL Server Instance Configuration

Configure the MySQL Server 5.0 server instance.

Please set the approximate number of concurrent connections to the server.

☐ **Decision Support (DSS)/OLAP**
Select this option for database applications that will not require a high number of concurrent connections. A number of 20 connections will be assumed.

☐ **Online Transaction Processing (OLTP)**
Choose this option for highly concurrent applications that may have at any one time up to 500 active connections such as heavily loaded web servers.

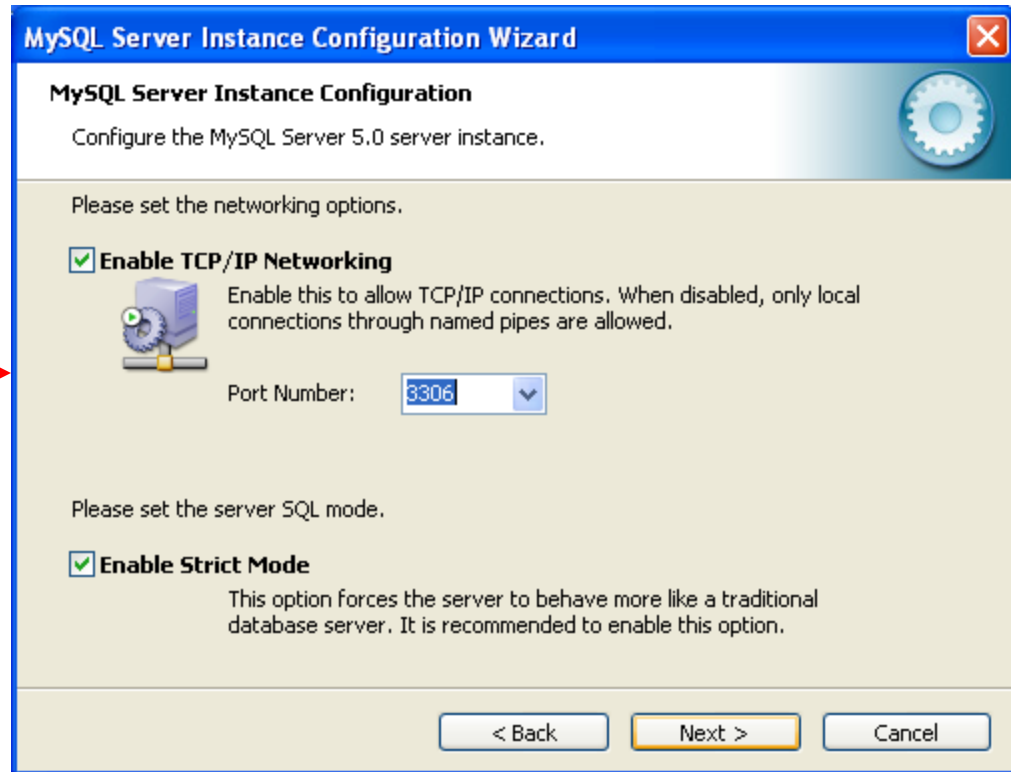
☒ **Manual Setting**
Please enter the approximate number of concurrent connections.
Concurrent connections: 10

< Back Next > Cancel



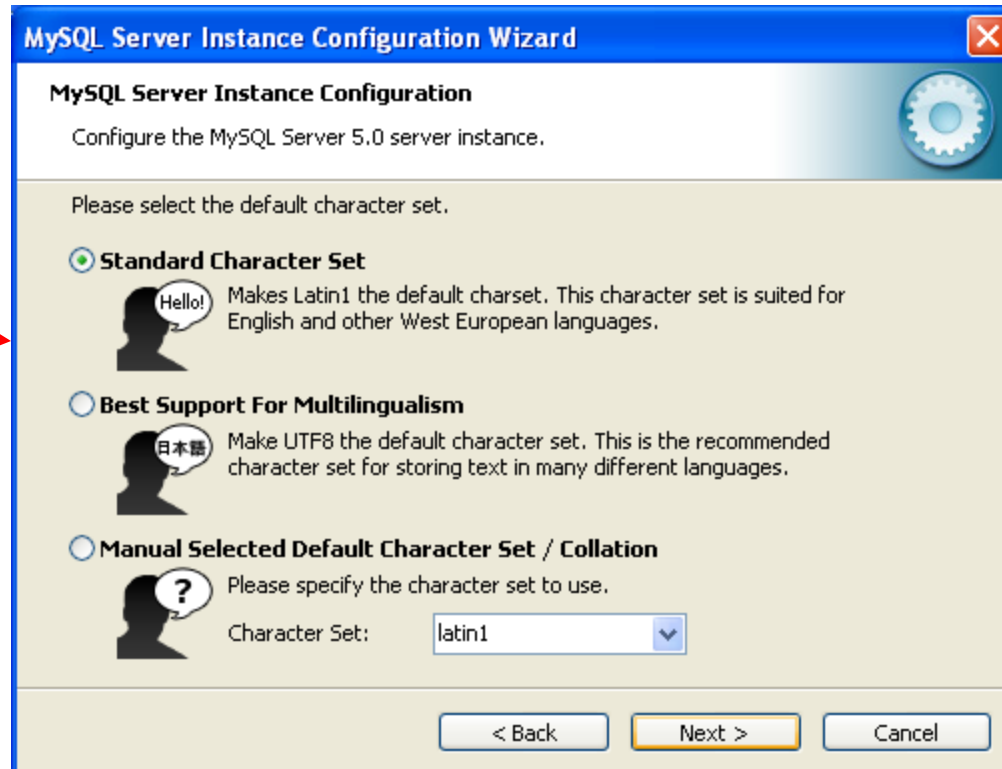
Installing MySQL 5.0 (cont.)

Accept all
defaults in this
window



Installing MySQL 5.0 (cont.)

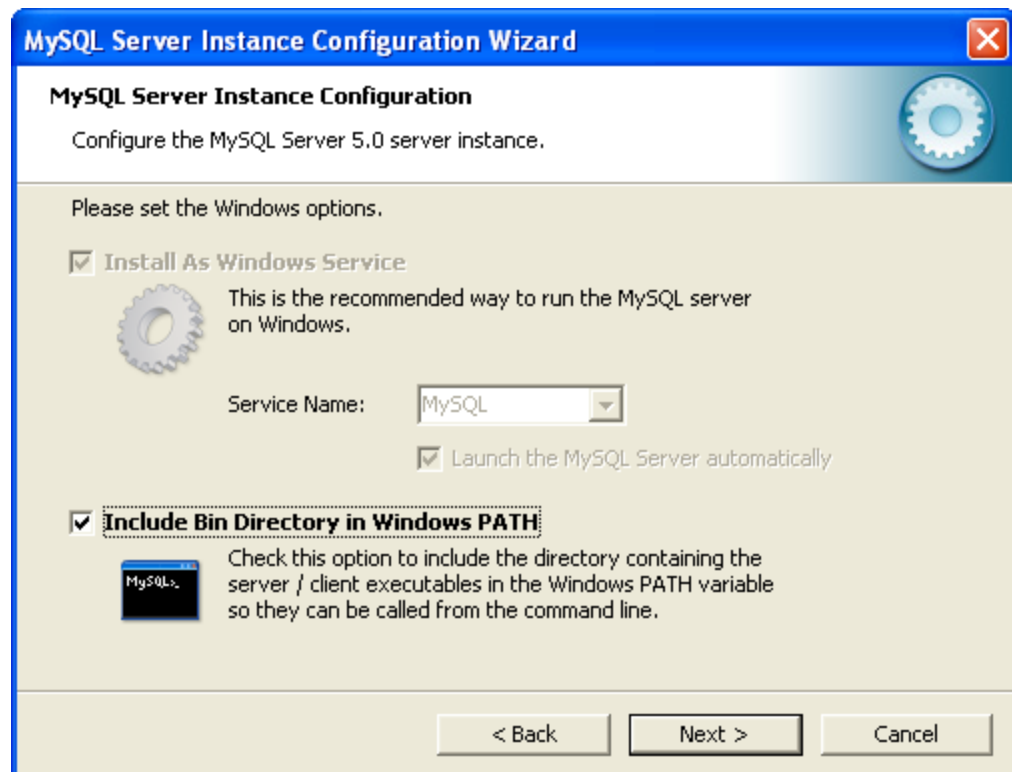
Your choice
again



Installing MySQL 5.0 (cont.)

Accept default options

This option is not marked by default, but you can mark and accept it if you want to include MySQL file locations in your PATH statement.



Installing MySQL 5.0 (cont.)

Accept default setting and enter a password for the root (superuser with all privileges by default). Enabling root access from remote machines is only necessary if you will be accessing the DB as the root user from a remote machine – we will not be doing this in this course.

Do not enable this option

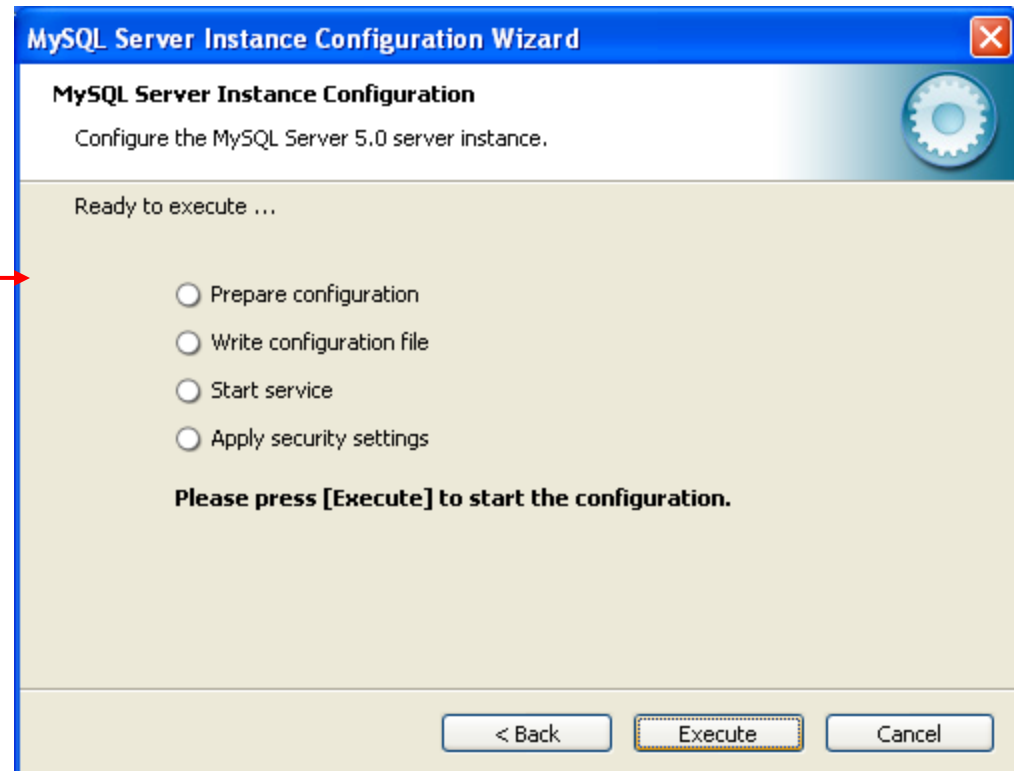


The image shows the 'MySQL Server Instance Configuration Wizard' window. The title bar reads 'MySQL Server Instance Configuration Wizard'. The main heading is 'MySQL Server Instance Configuration' with a subtitle 'Configure the MySQL Server 5.0 server instance.' Below this, it says 'Please set the security options.' There are two main sections. The first section is 'Modify Security Settings', which is checked with a green box. It includes a 'root' user icon, a 'New root password:' field, a 'Confirm:' field, and an unchecked checkbox for 'Enable root access from remote machines'. The second section is 'Create An Anonymous Account', which is unchecked. It includes a question mark icon and a warning: 'This option will create an anonymous account on this server. Please note that this can lead to an insecure system.' At the bottom, there are three buttons: '< Back', 'Next >', and 'Cancel'.



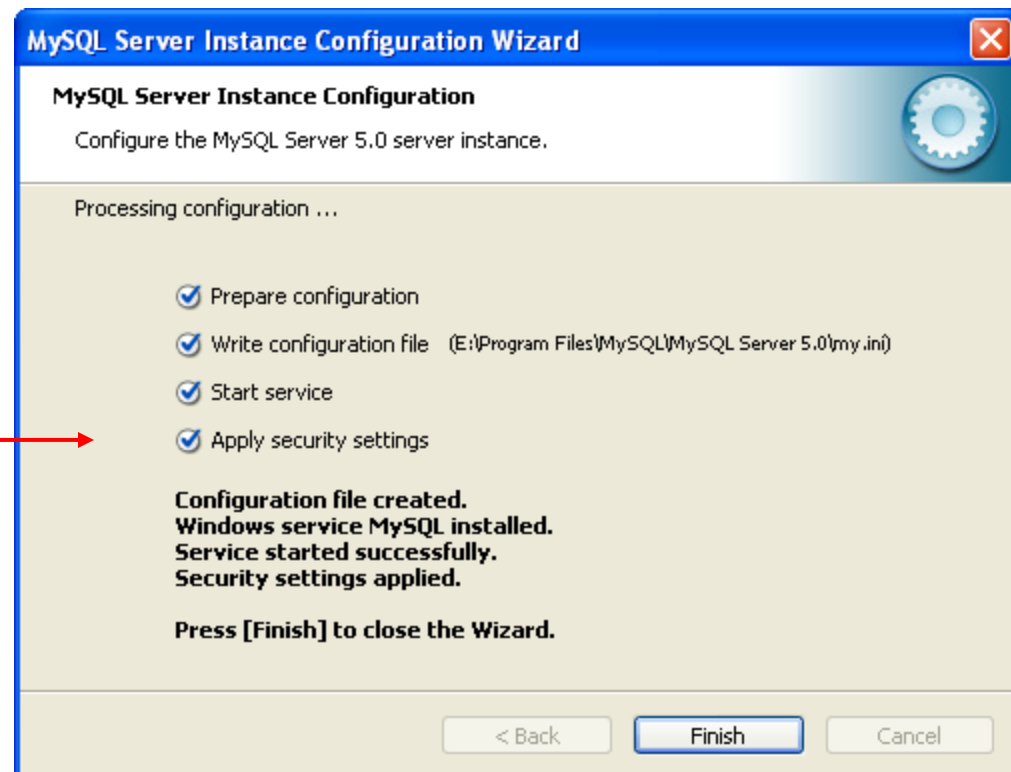
Installing MySQL 5.0 (cont.)

Configuration is about to begin. Now cross your fingers, toes, and anything else you have, take a deep breath, click the Execute button and close your eyes for a few seconds.



Installing MySQL 5.0 (cont.)

You've successfully
installed MySQL!!



Running MySQL 5.0.67

- If you've successfully installed MySQL, it should now be running as a service on your machine. It will start automatically when your machine boots.
- Go into your listing of programs (from the start menu at the bottom: All Programs) and you should see MySQL appear. Since you will be running MySQL clients a lot, it will be easier if you pin the MySQL Client to the start menu.
- To verify that MySQL is running properly as a service you can either check the process window or run a MySQL client.



Running MySQL 5.0.67 (cont.)

MySQL Command Line Client

```
Enter password: ****
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 4
Server version: 5.0.67-community-nt MySQL Community Edition (GPL)

Type 'help;' or '\h' for help. Type '\c' to clear the buffer.
```

```
mysql> status;
```

```
E:\Program Files\MySQL\MySQL Server 5.0\bin\mysql.exe  Ver 14.12 Distrib 5.0.67, for Win32 (ia32)
```

```
Connection id:          4
Current database:
Current user:            root@localhost
SSL:                     Not in use
Using delimiter:        ;
Server version:          5.0.67-community-nt MySQL Community Edition (GPL)
Protocol version:        10
Connection:              localhost via TCP/IP
Server characterset:     latin1
Db characterset:         latin1
Client characterset:     latin1
Conn. characterset:      latin1
TCP port:                3306
Uptime:                  1 min 53 sec
```

```
Threads: 1  Questions: 15  Slow queries: 0  Opens: 12  Flush tables: 1  Open tables: 6  Queries per second avg: 0.133
```

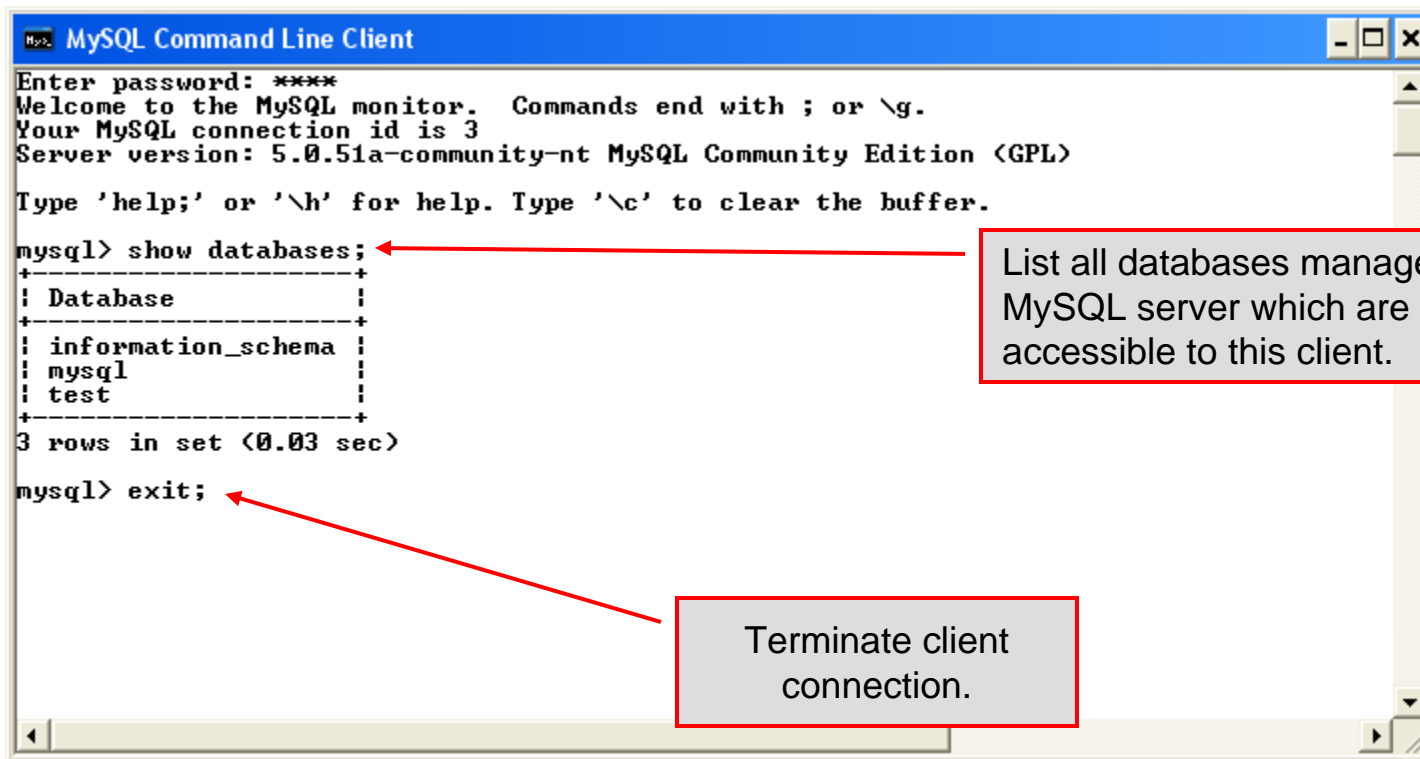
```
mysql>
```

Enter the password you provided during the MySQL installation procedure as the root user.

Hopefully, you see this output from MySQL. The MySQL server is now awaiting a command from this client.



Running MySQL 5.0.67 (cont.)



The screenshot shows a window titled "MySQL Command Line Client". The text inside the window is as follows:

```
Enter password: ****
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 3
Server version: 5.0.51a-community-nt MySQL Community Edition (GPL)

Type 'help;' or '\h' for help. Type '\c' to clear the buffer.

mysql> show databases;
+-----+
| Database |
+-----+
| information_schema |
| mysql      |
| test       |
+-----+
3 rows in set (0.03 sec)

mysql> exit;
```

Two red arrows point from text boxes to specific parts of the screenshot. One arrow points from the text box "List all databases managed by this MySQL server which are accessible to this client." to the "show databases;" command. The other arrow points from the text box "Terminate client connection." to the "exit;" command.

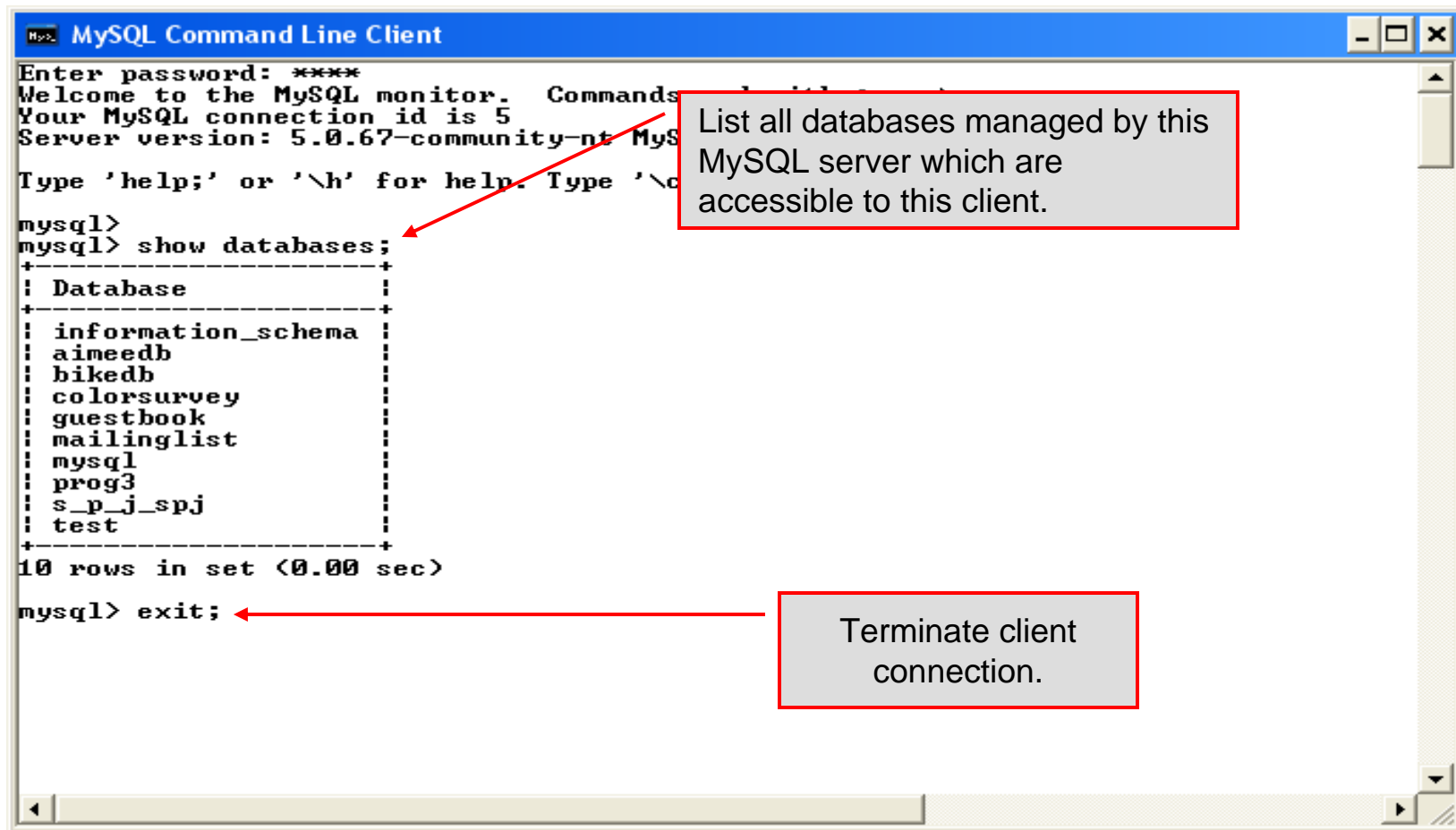
List all databases managed by this MySQL server which are accessible to this client.

Terminate client connection.

New Installations Only!



Running MySQL 5.0.67 (cont.)



```
MySQL Command Line Client
Enter password: ****
Welcome to the MySQL monitor.  Commands
Your MySQL connection id is 5
Server version: 5.0.67-community-nt MySQL
Type 'help;' or '\h' for help. Type '\c' to
mysql>
mysql> show databases;
+-----+
| Database |
+-----+
| information_schema |
| aineedb       |
| bikedb        |
| colorsurvey   |
| guestbook     |
| mailinglist   |
| mysql         |
| prog3         |
| s_p_j_spj     |
| test         |
+-----+
10 rows in set (0.00 sec)

mysql> exit;
```

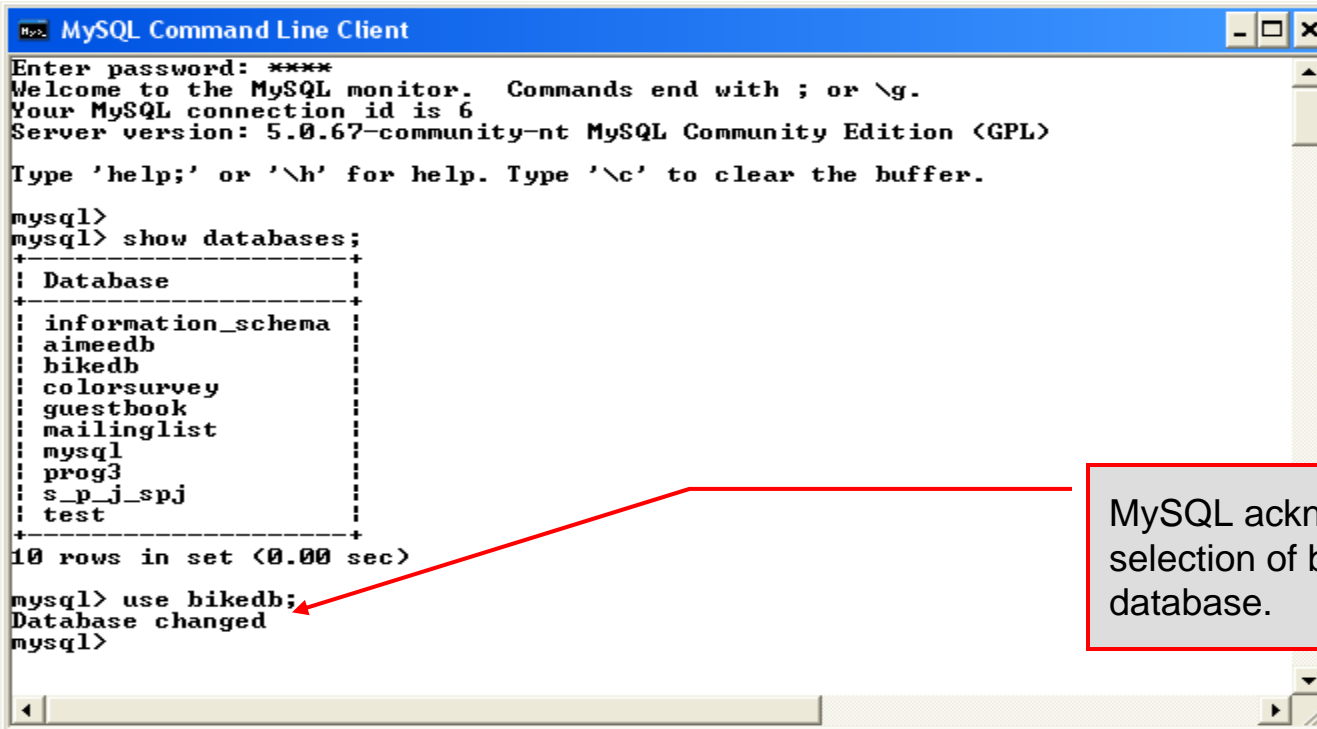
List all databases managed by this MySQL server which are accessible to this client.

Terminate client connection.



Specifying A Database Within MySQL

- Unless, it is specifically stated, in the following slides we'll assume that the user has root-level privileges.
- To select a database for use in MySQL the use command must be issued. In the example below, we'll select the bikedb database.



```
MySQL Command Line Client
Enter password: ****
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 6
Server version: 5.0.67-community-nt MySQL Community Edition (GPL)

Type 'help;' or '\h' for help. Type '\c' to clear the buffer.

mysql>
mysql> show databases;
+-----+
| Database |
+-----+
| information_schema |
| aimeedb   |
| bikedb    |
| colorsurvey |
| guestbook |
| mailinglist |
| mysql     |
| prog3     |
| s_p_j_spj |
| test      |
+-----+
10 rows in set (0.00 sec)

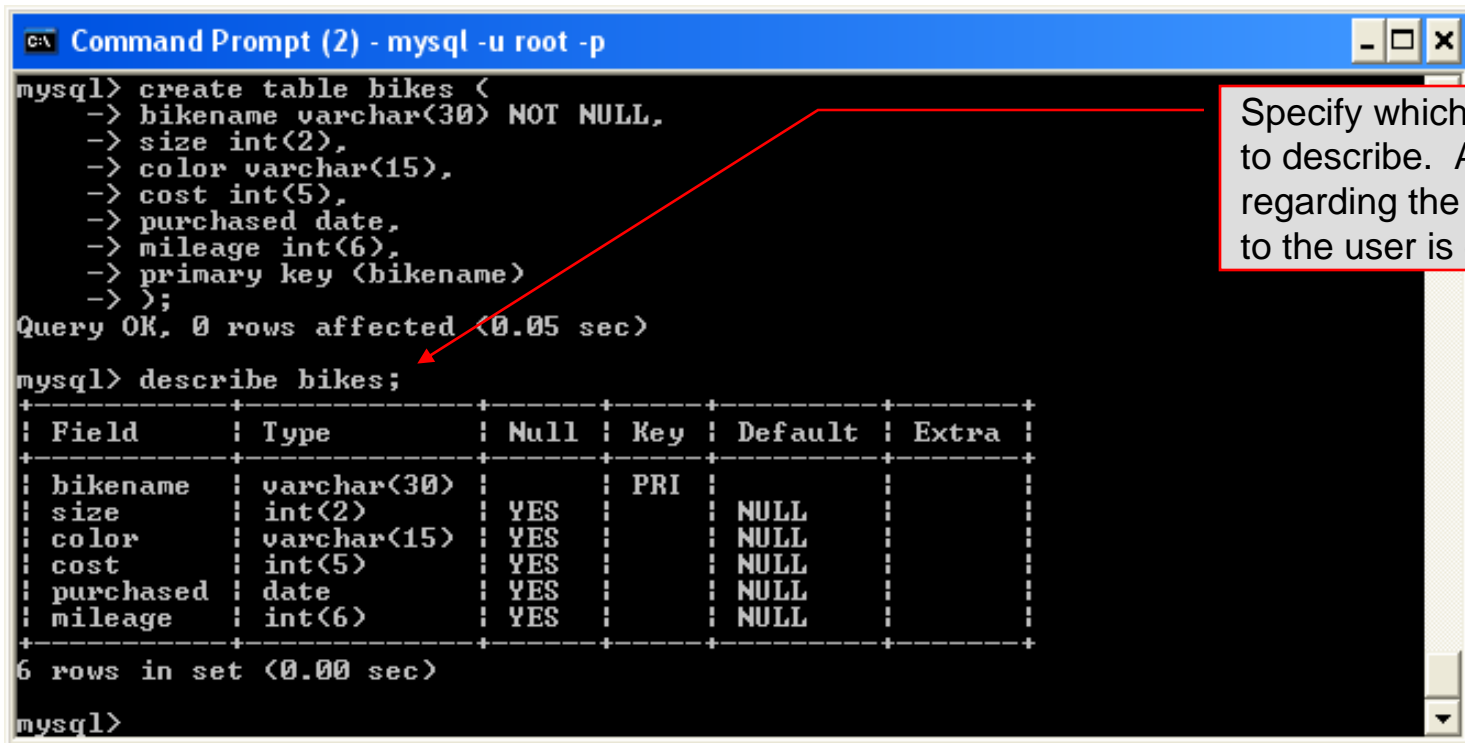
mysql> use bikedb;
Database changed
mysql>
```

MySQL acknowledges selection of bikedb database.



Viewing the Schema of a Relation

- To see the schema of a relation within a database, use the `describe <tablename>` command as illustrated below.



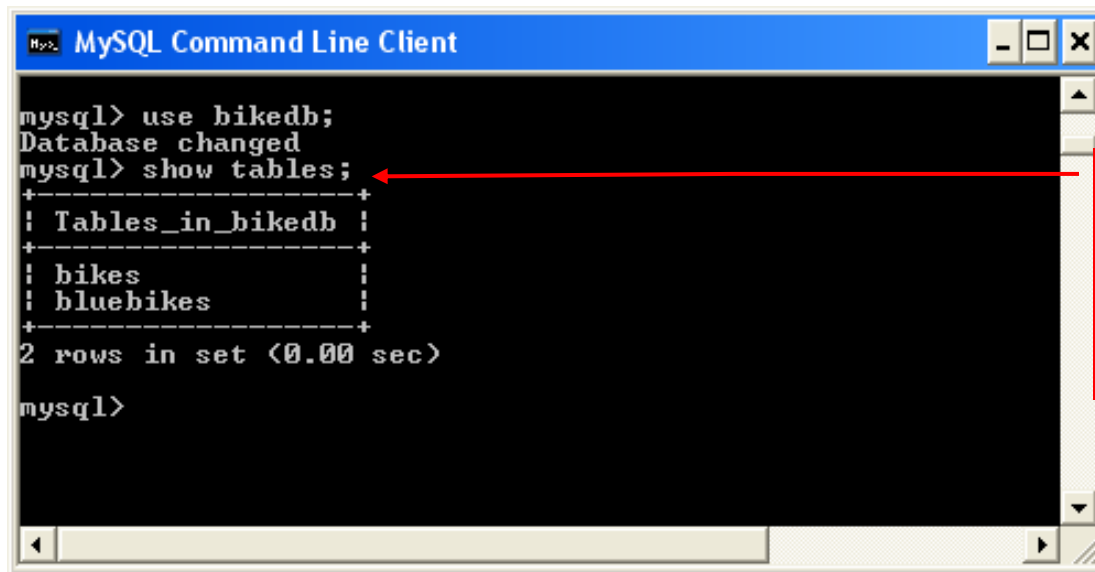
Specify which table's schema to describe. All information regarding the schema visible to the user is displayed.

```
mysql> create table bikes (  
  -> bikename varchar(30) NOT NULL,  
  -> size int(2),  
  -> color varchar(15),  
  -> cost int(5),  
  -> purchased date,  
  -> mileage int(6),  
  -> primary key (bikename)  
  -> );  
Query OK, 0 rows affected (0.05 sec)  
  
mysql> describe bikes;  
+-----+-----+-----+-----+-----+-----+  
| Field | Type | Null | Key | Default | Extra |  
+-----+-----+-----+-----+-----+-----+  
| bikename | varchar(30) | YES | PRI | NULL | |  
| size | int(2) | YES | | NULL | |  
| color | varchar(15) | YES | | NULL | |  
| cost | int(5) | YES | | NULL | |  
| purchased | date | YES | | NULL | |  
| mileage | int(6) | YES | | NULL | |  
+-----+-----+-----+-----+-----+-----+  
6 rows in set (0.00 sec)  
  
mysql>
```



Viewing the Relations of a Database

- Once a database has been selected you can see the relations (tables) within that database with the `show tables` command as illustrated below.



```
mysql> use bikedb;
Database changed
mysql> show tables;
+-----+
| Tables_in_bikedb |
+-----+
| bikes             |
| bluebikes         |
+-----+
2 rows in set (0.00 sec)

mysql>
```

Show tables command lists all the relations within a database visible to the user. There are two tables in this database.



Running a Simple Select Query in MySQL

- Within the MySQL monitor, running an SQL query is straight forward. The example below illustrates a simple selection query on the bikes table of the bikedb database.

MySQL Command Line Client

```
mysql> select *  
-> from bikes;
```

bikename	size	color	cost	purchased	mileage
Battaglin Carrera	60	red/white	4000	2001-03-14	11200
Bianchi Corse Evo 4	58	celeste	5700	2004-12-22	300
Bianchi Evolution 3	58	celeste	4800	2003-11-16	2000
Colnago Dream Rabobank	60	blue/orange	5500	2002-07-27	4300
Colnago Superissimo	59	red	3800	1996-03-01	13000
Eddy Merckx Domo	58	blue/black	5300	2004-02-02	0
Eddy Merckx Molteni	58	orange	5100	2004-08-12	0
Gianni Motta Personal	59	red/green	4400	2000-05-01	8700
Gios Torino Super	60	blue	2000	1998-11-08	9000
Schwinn Paramount P14	60	blue	1800	1992-03-01	200

10 rows in set (0.00 sec)

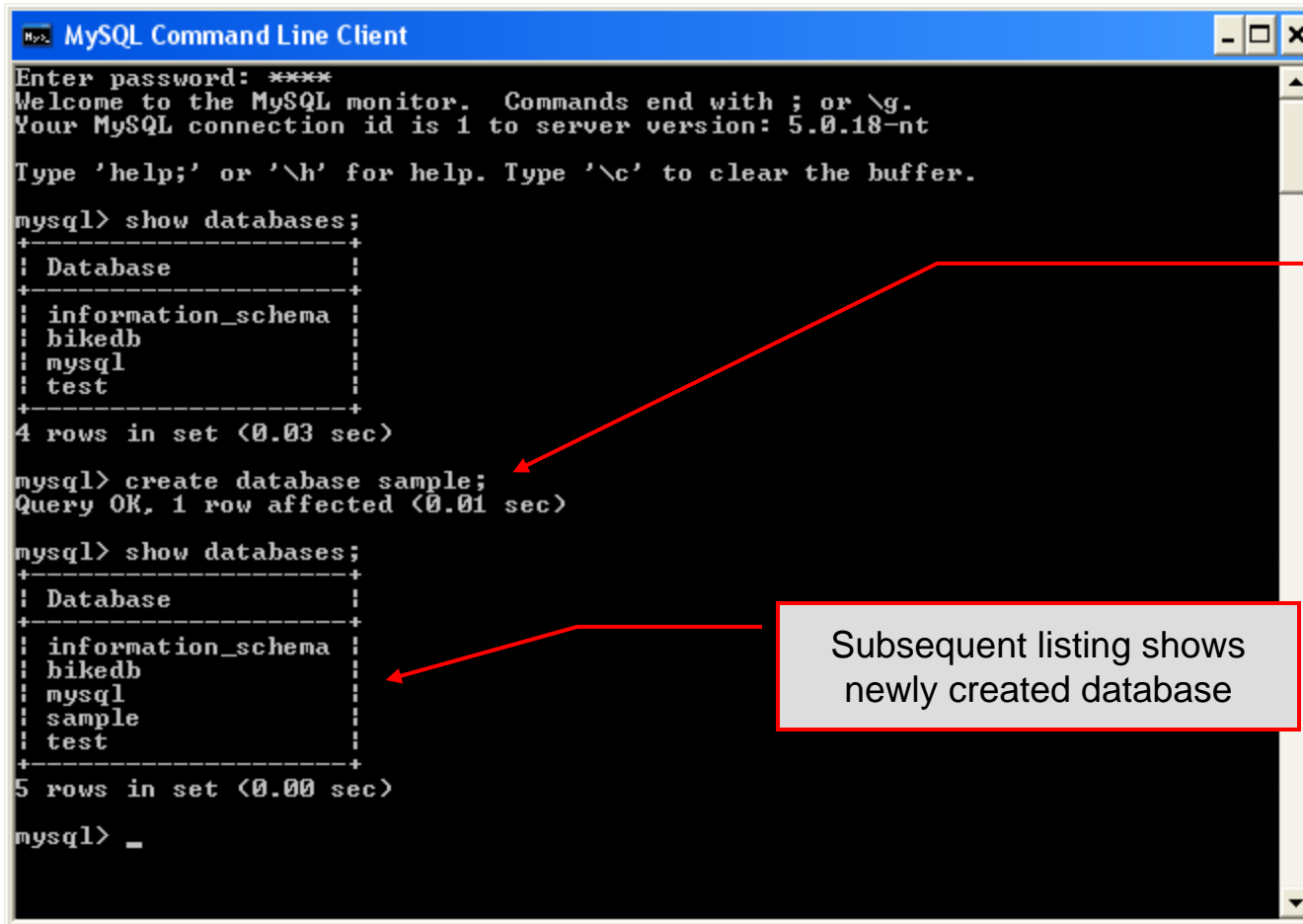
```
mysql> _
```

The tuples within the bikes table are displayed as the result of the query.



Creating a Database in MySQL

- From the MySQL monitor enter create database <db name>



```
MySQL Command Line Client
Enter password: ****
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 1 to server version: 5.0.18-nt
Type 'help;' or '\h' for help. Type '\c' to clear the buffer.

mysql> show databases;
+-----+
| Database |
+-----+
| information_schema |
| bikedb    |
| mysql     |
| test      |
+-----+
4 rows in set (0.03 sec)

mysql> create database sample;
Query OK, 1 row affected (0.01 sec)

mysql> show databases;
+-----+
| Database |
+-----+
| information_schema |
| bikedb            |
| mysql             |
| sample            |
| test              |
+-----+
5 rows in set (0.00 sec)

mysql> _
```

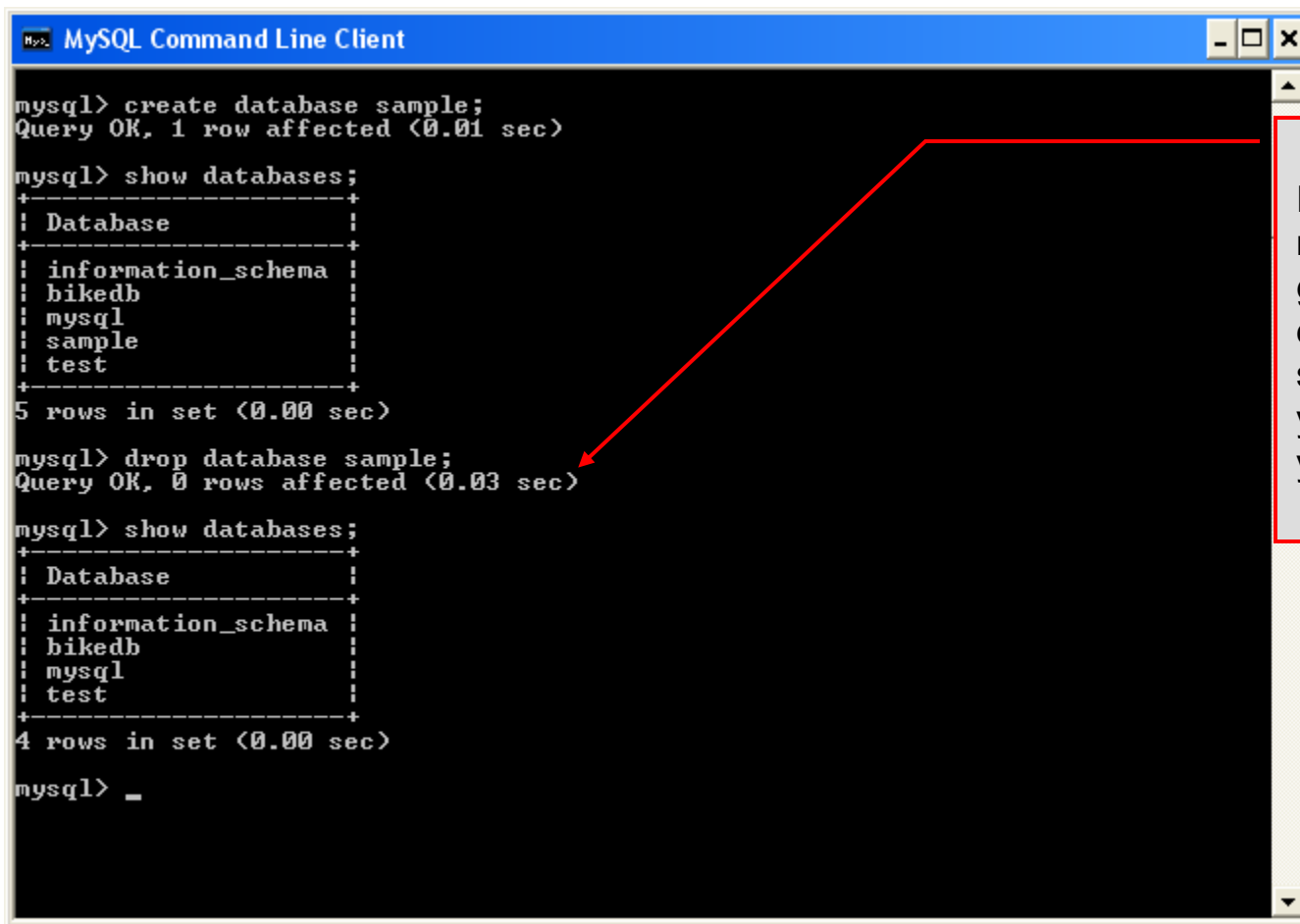
Create new database from within MySQL monitor.

Subsequent listing shows newly created database



Dropping a Database in MySQL

- From the MySQL monitor execute the `drop database <db name>` command.



The screenshot shows a MySQL Command Line Client window with a black background and white text. The window title is "MySQL Command Line Client". The command history shows the following steps:

```
mysql> create database sample;  
Query OK, 1 row affected (0.01 sec)  
  
mysql> show databases;  
+-----+  
| Database |  
+-----+  
| information_schema |  
| bikedb |  
| mysql |  
| sample |  
| test |  
+-----+  
5 rows in set (0.00 sec)  
  
mysql> drop database sample;  
Query OK, 0 rows affected (0.03 sec)  
  
mysql> show databases;  
+-----+  
| Database |  
+-----+  
| information_schema |  
| bikedb |  
| mysql |  
| test |  
+-----+  
4 rows in set (0.00 sec)  
  
mysql> _
```

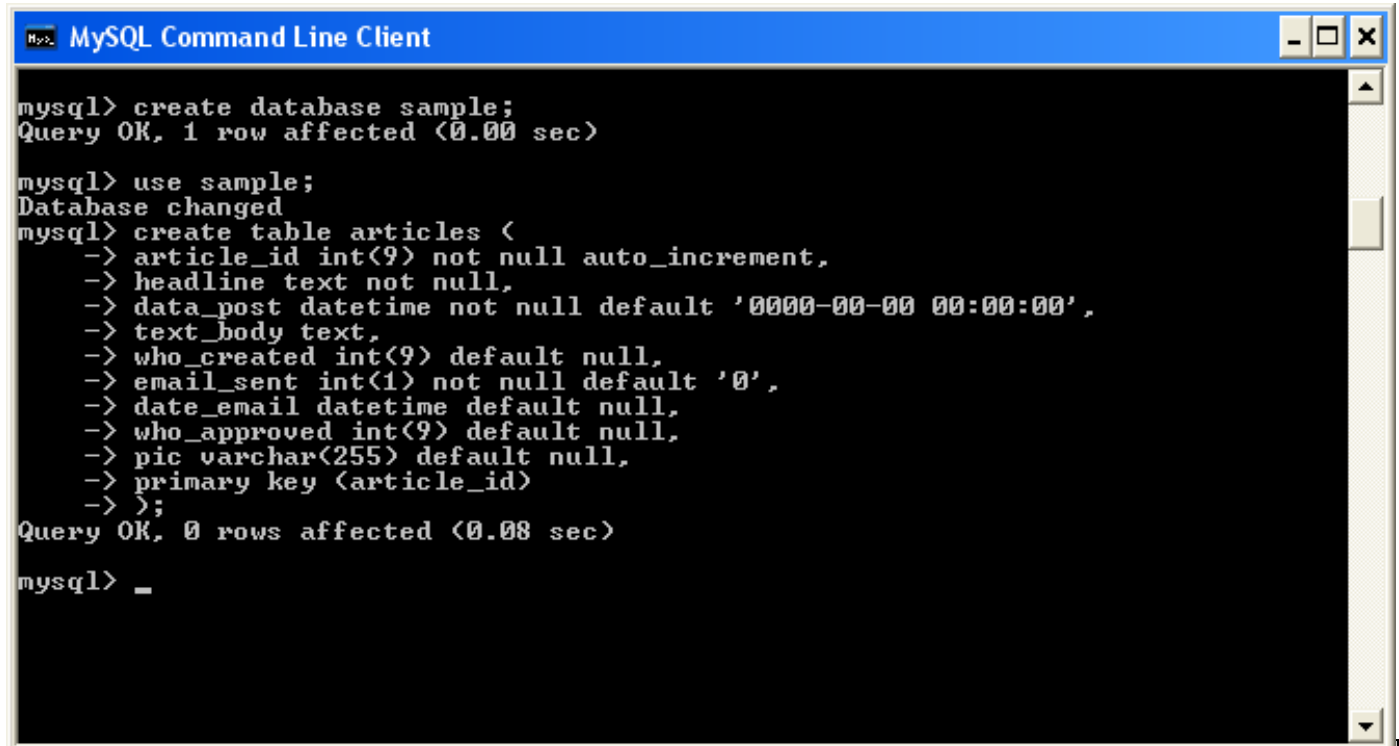
A red arrow points from the text box on the right to the `drop database sample;` command in the terminal.

From within the MySQL monitor, no warning is given when dropping a database. Be very sure that this is what you want to do before you do it.



Manipulating Tables in MySQL

- The creation of a database does not place any relations into the database. Relations must be separately created.
- To create a table within a database, first select the database (or create one if you haven't already done so), then execute the create table command.



```
MySQL Command Line Client

mysql> create database sample;
Query OK, 1 row affected (0.00 sec)

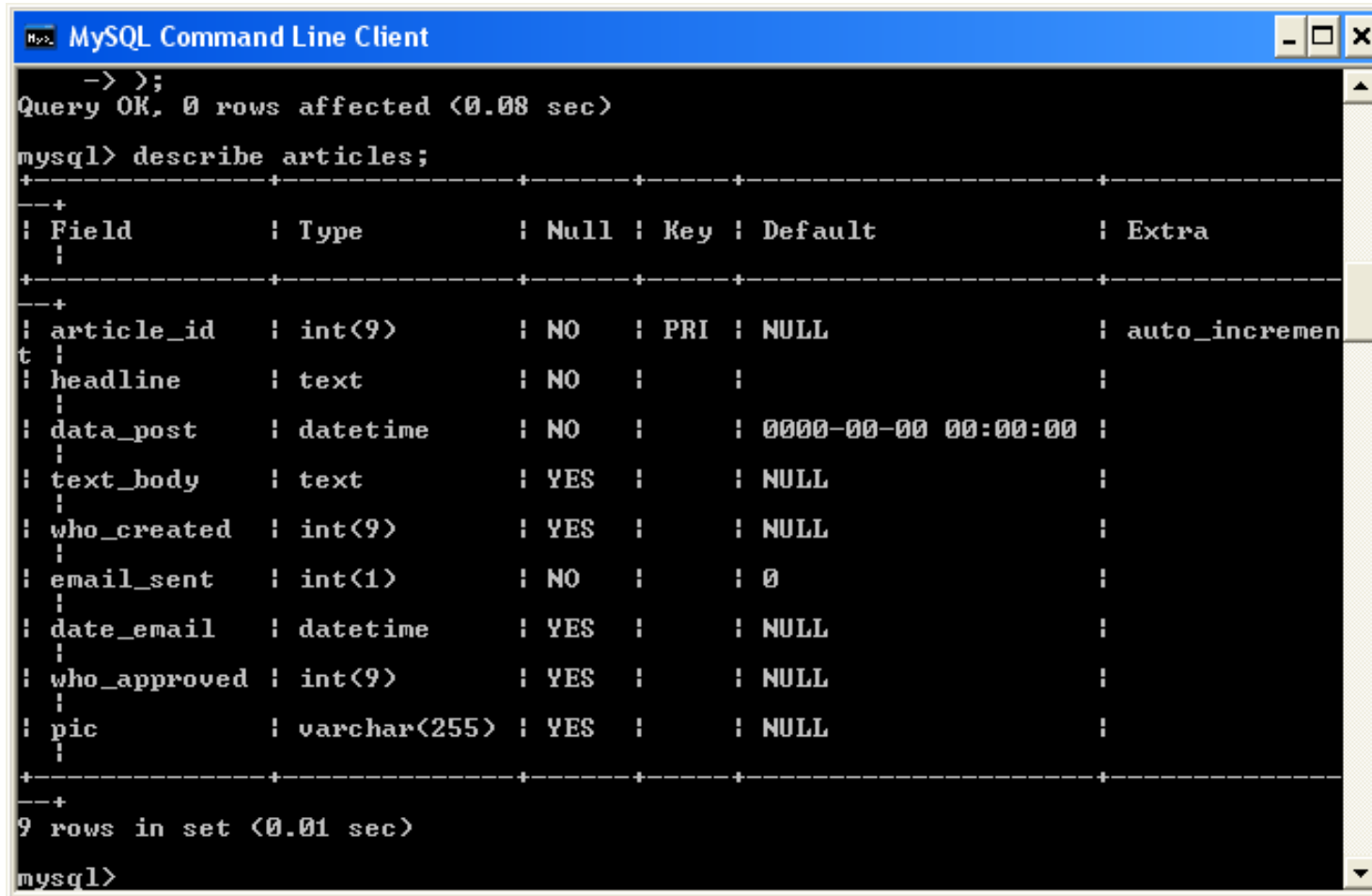
mysql> use sample;
Database changed
mysql> create table articles (
  -> article_id int(9) not null auto_increment,
  -> headline text not null,
  -> data_post datetime not null default '0000-00-00 00:00:00',
  -> text_body text,
  -> who_created int(9) default null,
  -> email_sent int(1) not null default '0',
  -> date_email datetime default null,
  -> who_approved int(9) default null,
  -> pic varchar(255) default null,
  -> primary key (article_id)
  -> );
Query OK, 0 rows affected (0.08 sec)

mysql> _
```



Manipulating Tables in MySQL (cont.)

Screen shot showing newly created table.



```
MySQL Command Line Client
-> >;
Query OK, 0 rows affected (0.08 sec)

mysql> describe articles;
+-----+-----+-----+-----+-----+-----+
| Field          | Type          | Null | Key | Default          | Extra          |
+-----+-----+-----+-----+-----+-----+
| article_id     | int(9)        | NO   | PRI | NULL             | auto_incremen |
| headline       | text          | NO   |     |                  |               |
| data_post      | datetime      | NO   |     | 0000-00-00 00:00:00 |               |
| text_body      | text          | YES  |     | NULL             |               |
| who_created    | int(9)        | YES  |     | NULL             |               |
| email_sent     | int(1)        | NO   |     | 0                |               |
| date_email     | datetime      | YES  |     | NULL             |               |
| who_approved   | int(9)        | YES  |     | NULL             |               |
| pic            | varchar(255)  | YES  |     | NULL             |               |
+-----+-----+-----+-----+-----+-----+
9 rows in set (0.01 sec)

mysql>
```



Manipulating Tables in MySQL (cont.)

- The `create table` command has the following general format:

```
create [temporary] table  
[if not exists] tablename  
[(create_definition, ...)]  
[table_options] [select_statement];
```

- If the `[if not exists]` clause is present, MySQL will produce an error message if a table with the specified name already exists in the database, otherwise the table is created.



Manipulating Tables in MySQL (cont.)

- A temporary table exists only for the life of the current database connection. It is automatically destroyed when the connection is closed or dies.
- Two different connections can use the same name for a temporary table without conflicting with one another.
- Temporary tables are most useful when queries get complex and intermediate results become useful. Also, versions of MySQL earlier than version 4.1 do not have subselect capability and temporary tables are a convenient way to simulate subselect query results.

Note: Non-root users require special permission to be able to create temporary tables. These users must have the `Create_tmp_tables` privilege set in the user grant table. We'll see more on this later.



Creating A Temporary Table From A Select Query

```
MySQL Command Line Client

mysql> select * from bikes;
+-----+-----+-----+-----+-----+-----+
| bikename      | size | color      | cost | purchased | mileage |
+-----+-----+-----+-----+-----+-----+
| Battaglin Carrera      | 60   | red/white  | 4000 | 2001-03-14 | 11200   |
| Bianchi Corse Evo 4    | 58   | celeste    | 5700 | 2004-12-22 | 300     |
| Bianchi Evolution 3    | 58   | celeste    | 4800 | 2003-11-16 | 2000    |
| Bianchi/Liquigas FG    | 58   | celeste/blue | 5600 | 2005-12-02 | 0        |
| Colnago Dream Rabobank | 60   | blue/orange | 5500 | 2002-07-27 | 4300    |
| Colnago Superissimo    | 59   | red        | 3800 | 1996-03-01 | 13000   |
| Eddy Merckx Domo       | 58   | blue/black | 5300 | 2005-02-02 | 0        |
| Eddy Merckx Molteni    | 58   | orange     | 5100 | 2004-08-12 | 0        |
| Gianni Motta Personal  | 59   | red/green  | 4400 | 2000-05-01 | 8700    |
| Gios Torino Super      | 60   | blue       | 2000 | 1998-11-08 | 9000    |
| Schwinn Paramount P14  | 60   | blue       | 1800 | 1992-03-01 | 200     |
+-----+-----+-----+-----+-----+-----+
11 rows in set (0.00 sec)

mysql> create temporary table celestebikes
-> select *
-> from bikes
-> where color = 'celeste';
Query OK, 2 rows affected (0.09 sec)
Records: 2  Duplicates: 0  Warnings: 0

mysql> show tables;
+-----+
| Tables_in_bikedb |
+-----+
| bikes             |
| bluebikes         |
+-----+
2 rows in set (0.00 sec)

mysql> select * from celestebikes;
+-----+-----+-----+-----+-----+-----+
| bikename      | size | color      | cost | purchased | mileage |
+-----+-----+-----+-----+-----+-----+
| Bianchi Corse Evo 4    | 58   | celeste    | 5700 | 2004-12-22 | 300     |
| Bianchi Evolution 3    | 58   | celeste    | 4800 | 2003-11-16 | 2000    |
+-----+-----+-----+-----+-----+-----+
2 rows in set (0.00 sec)

mysql>
```

A SELECT query produces a result set which has been extracted from one or more tables. A table can be created with the results of this data using the create table command.

Notice that temporary tables do not appear in a table listing.



Manipulating Tables in MySQL (cont.)

- Recall that the `create table` command has the following general format:

```
create [temporary] table  
[if not exists] tablename  
[ (create_definition, ... ) ]  
[ table_options ]  
[ select_statement ] ;
```

- The table options allow you to specify the MySQL table type. The table type can be anyone of the six types listed in the table on the next slide.



Manipulating Tables in MySQL (cont.)

Table Type	Description
ISAM	MySQL's original table handler
HEAP	The data for this table is only stored in memory
MyISAM	A binary portable table handler that has replaced ISAM
MERGE	A collection of MyISAM tables used as one table
BDB	Transaction-safe tables with page locking
InnoDB	Transaction-safe tables with row locking

MySQL Table Types

ISAM, HEAP, and MyISAM are available for MySQL versions 3.23.6 or later.

MERGE, BDB, and InnoDB are available for MySQL versions 4.0 and later.

Default table type is InnoDB for MySQL versions 5.0.x.



Altering A Table

- After a table has been created, it is possible to change the specifications of its schema. This is done through the `alter table` command:

```
alter table table_name action_list
```

- Note: Changing the schema of a table in a database is not something that is done very often once the database has been created. The time for altering the schema is during the design phase. Altering the schema of an operational database is a very dangerous thing.
- Multiple changes to the table can be made at the same time by separating actions with commas in the `action_list`.
- The possible attribute (column) actions that can be used are shown in the table on the following slide.



Altering A Table (cont.)

Action Syntax	Action Performed
<code>add [column] <i>column_declaration</i> [first after <i>column_name</i>]</code>	Add a column to the table
<code>alter [column] <i>column_name</i> {set default <i>literal</i> drop default}</code>	Specify new default value for a column or remove old default
<code>change [column] <i>column_name</i> <i>column_declaration</i></code>	Modify column declaration with renaming of column
<code>modify [column] <i>column_declaration</i></code>	Modify column declaration without renaming column
<code>drop [column] <i>column_name</i></code>	Drop a column and all data contained within it.
<code>rename [as] <i>new_table_name</i></code>	Rename a table
<code><i>table_options</i></code>	Change the table options

Actions performed by `alter table` (column related) command

column_name represents the current name of the column, *column_declaration* represents the new declaration, in the same format as if it were in a `create` command.



Altering A Table (cont.)

- The screen shot below shows an example of altering a table.

```
MySQL Command Line Client
mysql> use bikedb;
Database changed
mysql>
mysql>
mysql> describe bikes;
+-----+-----+-----+-----+-----+-----+
| Field      | Type          | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+-----+
| bikename   | varchar(30)   | NO   | PRI |          |       |
| size       | int(2)        | YES  |     | NULL    |       |
| color      | varchar(15)   | YES  |     | NULL    |       |
| cost       | int(6)        | YES  |     | NULL    |       |
| purchased  | date          | YES  |     | NULL    |       |
| mileage    | int(6)        | YES  |     | NULL    |       |
+-----+-----+-----+-----+-----+-----+
6 rows in set (0.06 sec)

mysql> alter table bikes
-> add column races_won int(3) default 0;
Query OK, 11 rows affected (0.22 sec)
Records: 11 Duplicates: 0 Warnings: 0

mysql> describe bikes;
+-----+-----+-----+-----+-----+-----+
| Field      | Type          | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+-----+
| bikename   | varchar(30)   | NO   | PRI |          |       |
| size       | int(2)        | YES  |     | NULL    |       |
| color      | varchar(15)   | YES  |     | NULL    |       |
| cost       | int(6)        | YES  |     | NULL    |       |
| purchased  | date          | YES  |     | NULL    |       |
| mileage    | int(6)        | YES  |     | NULL    |       |
| races_won  | int(3)        | YES  |     | 0       |       |
+-----+-----+-----+-----+-----+-----+
7 rows in set (0.01 sec)

mysql>
```

Schema of bikes
before alteration

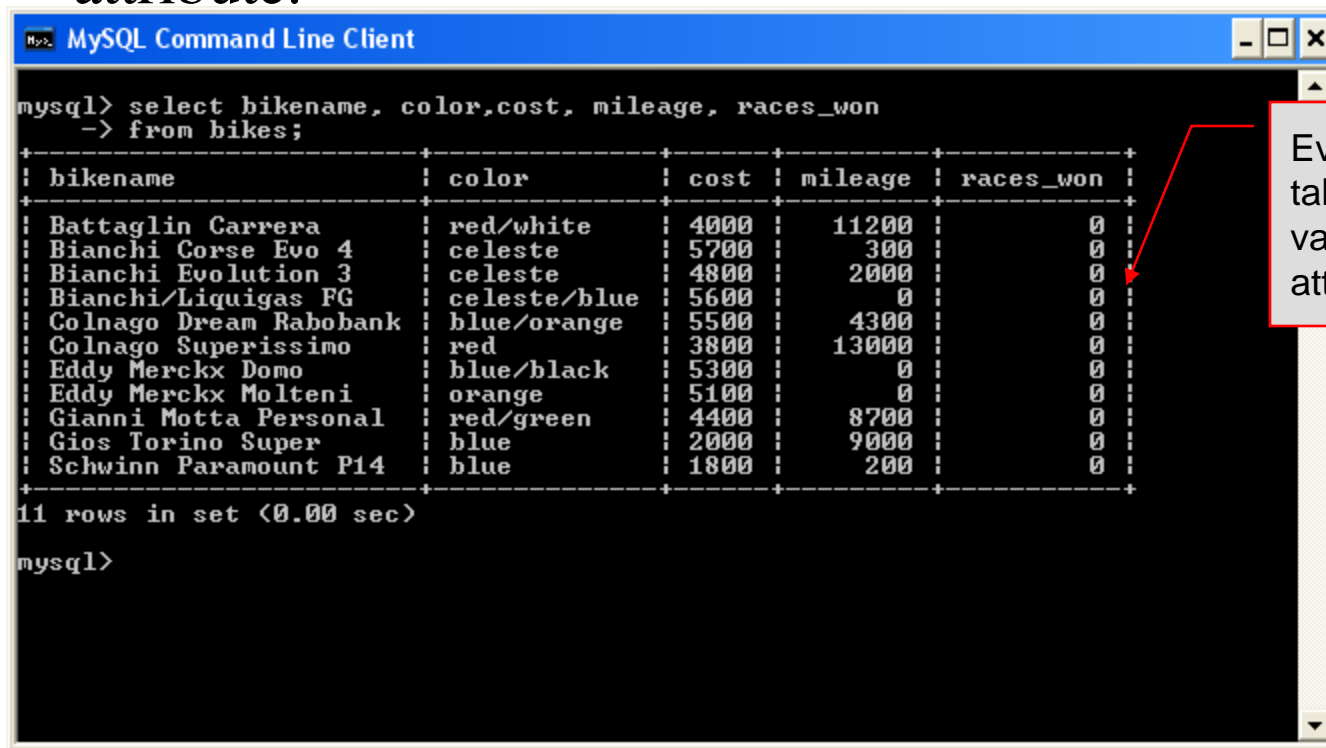
There are 11 rows affected
because this table currently
contains 11 tuples (rows) and
the new attribute has been
added to all rows.

Bikes table after the
addition of a new column
named races_won



Altering A Table (cont.)

- The screen shot below shows the tuples currently in the bikes table after the addition of the new attribute illustrating that all of the tuples have assumed the default value on the new attribute.



```
mysql> select bikeName, color, cost, mileage, races_won
-> from bikes;
```

bikeName	color	cost	mileage	races_won
Battaglin Carrera	red/white	4000	11200	0
Bianchi Corse Evo 4	celeste	5700	300	0
Bianchi Evolution 3	celeste	4800	2000	0
Bianchi/Liquigas FG	celeste/blue	5600	0	0
Colnago Dream Rabobank	blue/orange	5500	4300	0
Colnago Superissimo	red	3800	13000	0
Eddy Merckx Domo	blue/black	5300	0	0
Eddy Merckx Molteni	orange	5100	0	0
Gianni Motta Personal	red/green	4400	8700	0
Gios Torino Super	blue	2000	9000	0
Schwinn Paramount P14	blue	1800	200	0

```
11 rows in set (0.00 sec)

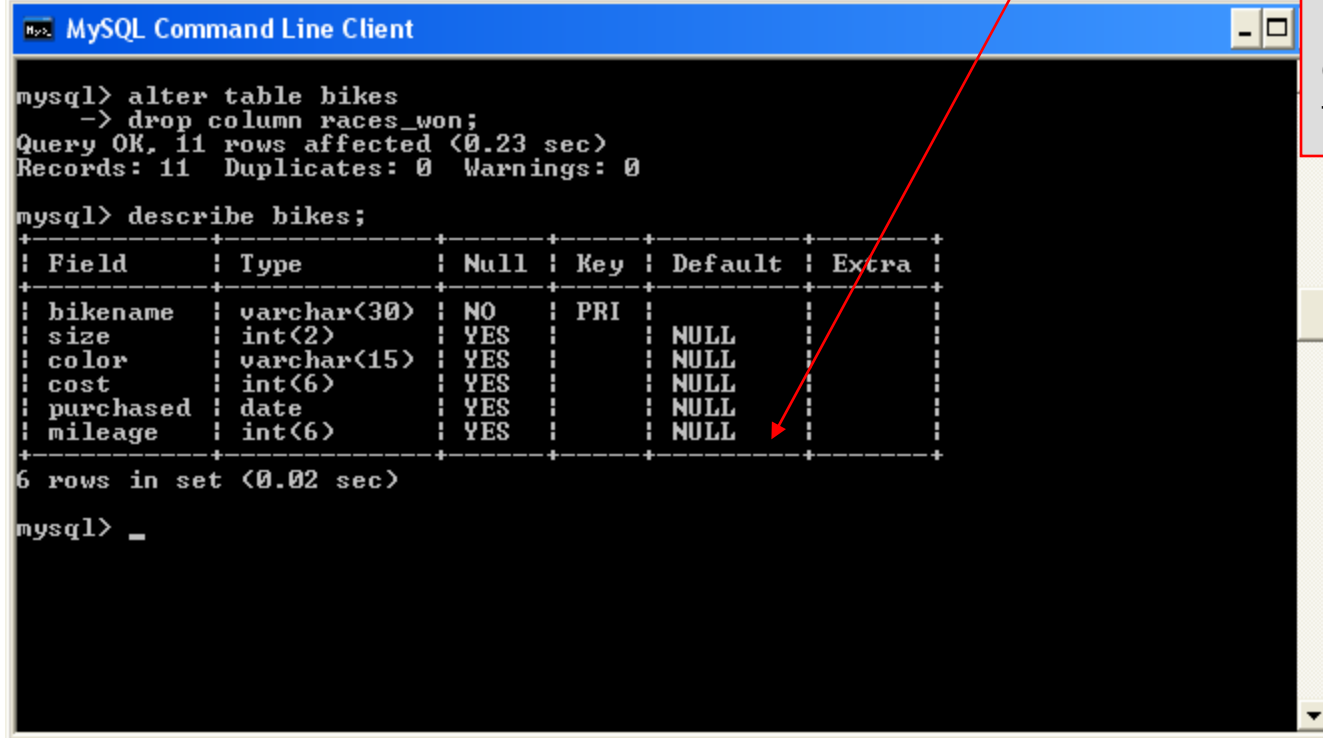
mysql>
```

Every tuple in the table has the default value for the new attribute.



Altering A Table (cont.)

- The screen shot below illustrates dropping a column from a table.
- Note that in general, this type of operation may not always be allowed due to constraint violations.



```
mysql> alter table bikes
-> drop column races_won;
Query OK, 11 rows affected (0.23 sec)
Records: 11 Duplicates: 0 Warnings: 0

mysql> describe bikes;
+-----+-----+-----+-----+-----+-----+
| Field | Type | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+-----+
| bikename | varchar(30) | NO | PRI | NULL |  |
| size | int(2) | YES |  | NULL |  |
| color | varchar(15) | YES |  | NULL |  |
| cost | int(6) | YES |  | NULL |  |
| purchased | date | YES |  | NULL |  |
| mileage | int(6) | YES |  | NULL |  |
+-----+-----+-----+-----+-----+-----+
6 rows in set (0.02 sec)

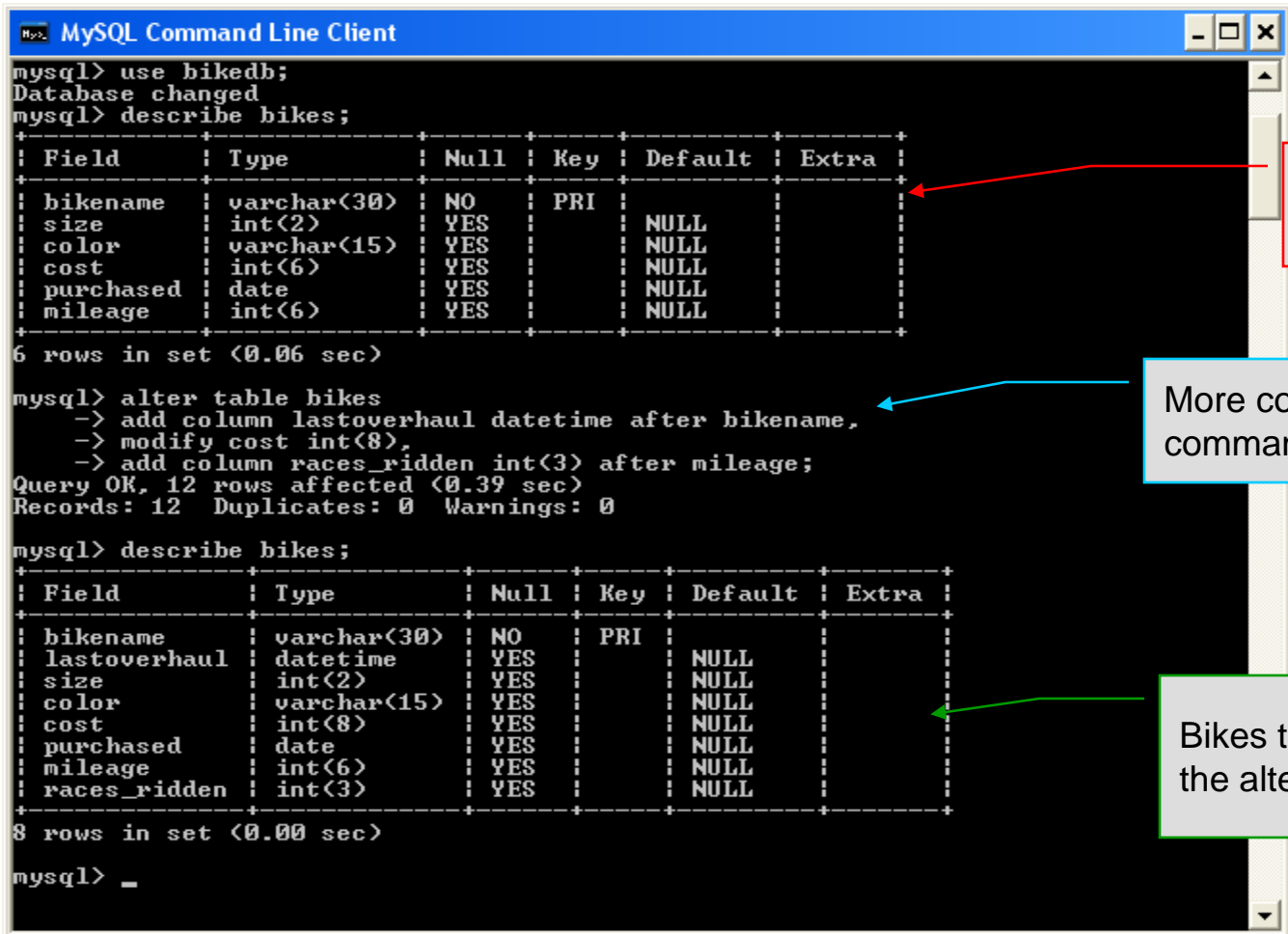
mysql> _
```

The attribute `races_won` has been eliminated from the table.



Altering A Table (cont.)

- The screen shot below shows a more complicated example of altering a table.



The screenshot shows a MySQL Command Line Client window. The user has entered the following commands:

```
mysql> use bikedb;
Database changed
mysql> describe bikes;
```

The output of the `describe bikes;` command shows the schema of the `bikes` table before alteration:

Field	Type	Null	Key	Default	Extra
bikename	varchar(30)	NO	PRI		
size	int(2)	YES		NULL	
color	varchar(15)	YES		NULL	
cost	int(6)	YES		NULL	
purchased	date	YES		NULL	
mileage	int(6)	YES		NULL	

6 rows in set (0.06 sec)

The user then enters the following `alter table` command:

```
mysql> alter table bikes
-> add column lastoverhaul datetime after bikename,
-> modify cost int(8),
-> add column races_ridden int(3) after mileage;
```

The output of the `alter table` command is:

```
Query OK, 12 rows affected (0.39 sec)
Records: 12 Duplicates: 0 Warnings: 0
```

The user then enters the `describe bikes;` command again to show the schema of the `bikes` table after alteration:

Field	Type	Null	Key	Default	Extra
bikename	varchar(30)	NO	PRI		
lastoverhaul	datetime	YES		NULL	
size	int(2)	YES		NULL	
color	varchar(15)	YES		NULL	
cost	int(8)	YES		NULL	
purchased	date	YES		NULL	
mileage	int(6)	YES		NULL	
races_ridden	int(3)	YES		NULL	

8 rows in set (0.00 sec)

mysql> _

Three callouts are present:

- A red box labeled "Schema of bikes before alteration" points to the first `describe bikes;` output.
- A blue box labeled "More complicated alter table command." points to the `alter table bikes` command.
- A green box labeled "Bikes table after the alteration" points to the second `describe bikes;` output.



Inserting Data Into A Table

- Data can be entered into a MySQL table using either the `insert` or `replace` commands.
- The `insert` statement is the primary way of getting data into the database and has the following form:

Form 1 `insert [low priority | delayed] [ignore] [into]table_name`
`[set] column_name1 = expression1,`
`column_name2 = expression2, ...`

Form 2 `insert [low priority | delayed] [ignore] [into]table_name`
`[(column_name,...)]values (expression,...), (...)`

Form 3 `insert [low priority | delayed] [ignore] [into]table_name`
`[(column_name,...)] select...`



Inserting Data Into A Table (cont.)

- Form 1 of the insert statement is the most verbose, but also the most common. The `set` clause explicitly names each column and states what value (evaluated from each `expression`) should be put into the table.
- Form 2 (insert values) requires just a comma separated list of the data. For each row inserted, each data value must correspond with a column. In other words, the number of values listed must match the number of columns and the order of the value list must be the same as the columns. (In form 1, the order is not critical since each column is named.)
- Form 3 is used to insert data into a table which is the result set of a `select` statement. This is similar to the temporary table example seen earlier in the notes.
- The following couple of pages give some examples of the different forms of the `insert` command.



Examples: Inserting Data Into A Table

```

mysql> select * from bikes;
+-----+-----+-----+-----+-----+-----+
| bikename | size | color | cost | purchased | mileage |
+-----+-----+-----+-----+-----+-----+
| Battaglin Carrera | 60 | red/white | 4000 | 2001-03-14 | 11200 |
| Bianchi Corse Evo 4 | 58 | celeste | 5700 | 2004-12-22 | 300 |
| Bianchi Evolution 3 | 58 | celeste | 4800 | 2003-11-16 | 2000 |
| Bianchi/Liquigas FG | 58 | celeste/blue | 5600 | 2005-12-02 | 0 |
| Colnago Dream Rabobank | 60 | blue/orange | 5500 | 2002-07-27 | 4300 |
| Colnago Superissimo | 59 | red | 3800 | 1996-03-01 | 13000 |
| Eddy Merckx Domo | 58 | blue/black | 5300 | 2005-02-02 | 0 |
| Eddy Merckx Molteni | 58 | orange | 5100 | 2004-08-12 | 0 |
| Gianni Motta Personal | 59 | red/green | 4400 | 2000-05-01 | 8700 |
| Gios Torino Super | 60 | blue | 2000 | 1998-11-08 | 9000 |
| Schwinn Paramount P14 | 60 | blue | 1800 | 1992-03-01 | 200 |
+-----+-----+-----+-----+-----+-----+
11 rows in set (0.00 sec)

mysql> insert into bikes
-> set bikename='Eddy Merckx MXM',
-> cost=8200,
-> mileage=150,
-> purchased='2006-01-14',
-> color='black/red',
-> size=58;
Query OK, 1 row affected (0.03 sec)

mysql> select * from bikes;
+-----+-----+-----+-----+-----+-----+
| bikename | size | color | cost | purchased | mileage |
+-----+-----+-----+-----+-----+-----+
| Battaglin Carrera | 60 | red/white | 4000 | 2001-03-14 | 11200 |
| Bianchi Corse Evo 4 | 58 | celeste | 5700 | 2004-12-22 | 300 |
| Bianchi Evolution 3 | 58 | celeste | 4800 | 2003-11-16 | 2000 |
| Bianchi/Liquigas FG | 58 | celeste/blue | 5600 | 2005-12-02 | 0 |
| Colnago Dream Rabobank | 60 | blue/orange | 5500 | 2002-07-27 | 4300 |
| Colnago Superissimo | 59 | red | 3800 | 1996-03-01 | 13000 |
| Eddy Merckx Domo | 58 | blue/black | 5300 | 2005-02-02 | 0 |
| Eddy Merckx Molteni | 58 | orange | 5100 | 2004-08-12 | 0 |
| Eddy Merckx MXM | 58 | black/red | 8200 | 2006-01-14 | 150 |
| Gianni Motta Personal | 59 | red/green | 4400 | 2000-05-01 | 8700 |
| Gios Torino Super | 60 | blue | 2000 | 1998-11-08 | 9000 |
| Schwinn Paramount P14 | 60 | blue | 1800 | 1992-03-01 | 200 |
+-----+-----+-----+-----+-----+-----+
12 rows in set (0.00 sec)

mysql>

```

Using Form 1
for insertion –
attribute order is
not important.



Examples: Inserting Data Into A Table

```
MySQL Command Line Client
mysql> select * from bikes;
+-----+-----+-----+-----+-----+-----+
| bikename      | size | color      | cost  | purchased | mileage |
+-----+-----+-----+-----+-----+-----+
| Battaglin Carrera      | 60   | red/white  | 4000  | 2001-03-14 | 11200  |
| Bianchi Corse Evo 4    | 58   | celeste    | 5700  | 2004-12-22 | 300    |
| Bianchi Evolution 3    | 58   | celeste    | 4800  | 2003-11-16 | 2000   |
| Bianchi/Liquigas FG    | 58   | celeste/blue | 5600  | 2005-12-02 | 0       |
| Colnago Dream Rabobank | 60   | blue/orange | 5500  | 2002-07-27 | 4300   |
| Colnago Superissimo    | 59   | red        | 3800  | 1996-03-01 | 13000  |
| Eddy Merckx Domo       | 58   | blue/black | 5300  | 2005-02-02 | 0       |
| Eddy Merckx Molteni    | 58   | orange     | 5100  | 2004-08-12 | 0       |
| Gianni Motta Personal  | 59   | red/green  | 4400  | 2000-05-01 | 8700   |
| Gios Torino Super      | 60   | blue       | 2000  | 1998-11-08 | 9000   |
| Schwinn Paramount P14  | 60   | blue       | 1800  | 1992-03-01 | 200    |
+-----+-----+-----+-----+-----+-----+
11 rows in set (0.00 sec)

mysql> insert into bikes
-> values ('Eddy Merckx MXM',58,'black/red',8200,'2006-01-14',150);
Query OK, 1 row affected (0.01 sec)

mysql> select * from bikes;
+-----+-----+-----+-----+-----+-----+
| bikename      | size | color      | cost  | purchased | mileage |
+-----+-----+-----+-----+-----+-----+
| Battaglin Carrera      | 60   | red/white  | 4000  | 2001-03-14 | 11200  |
| Bianchi Corse Evo 4    | 58   | celeste    | 5700  | 2004-12-22 | 300    |
| Bianchi Evolution 3    | 58   | celeste    | 4800  | 2003-11-16 | 2000   |
| Bianchi/Liquigas FG    | 58   | celeste/blue | 5600  | 2005-12-02 | 0       |
| Colnago Dream Rabobank | 60   | blue/orange | 5500  | 2002-07-27 | 4300   |
| Colnago Superissimo    | 59   | red        | 3800  | 1996-03-01 | 13000  |
| Eddy Merckx Domo       | 58   | blue/black | 5300  | 2005-02-02 | 0       |
| Eddy Merckx Molteni    | 58   | orange     | 5100  | 2004-08-12 | 0       |
| Eddy Merckx MXM       | 58   | black/red  | 8200  | 2006-01-14 | 150    |
| Gianni Motta Personal  | 59   | red/green  | 4400  | 2000-05-01 | 8700   |
| Gios Torino Super      | 60   | blue       | 2000  | 1998-11-08 | 9000   |
| Schwinn Paramount P14  | 60   | blue       | 1800  | 1992-03-01 | 200    |
+-----+-----+-----+-----+-----+-----+
12 rows in set (0.00 sec)

mysql>
```

Using Form 2
for insertion –
attribute order
is important.



Examples: Inserting Data Into A Table

```
MySQL Command Line Client
mysql>
mysql>
mysql> create table celestebikes like bikes;
Query OK, 0 rows affected (0.08 sec)

mysql> insert into celestebikes
-> select *
-> from bikes
-> where color = 'celeste';
Query OK, 2 rows affected (0.03 sec)
Records: 2 Duplicates: 0 Warnings: 0

mysql> select * from celestebikes;
+-----+-----+-----+-----+-----+-----+
| bikename      | size | color  | cost  | purchased | mileage |
+-----+-----+-----+-----+-----+-----+
| Bianchi Corse Evo 4 | 58   | celeste | 5700  | 2004-12-22 | 300    |
| Bianchi Evolution 3 | 58   | celeste | 4800  | 2003-11-16 | 2000   |
+-----+-----+-----+-----+-----+-----+
2 rows in set (0.00 sec)

mysql> _
```

Creates an initially empty table just like the bikes table

Using Form 3 for insertion

This table contains the name and cost of those bikes whose color was celeste from the source table.



Examples: Inserting Data Into A Table

```
MySQL Command Line Client

mysql>
mysql> create table celestebikes (
  -> name varchar(30),
  -> paint varchar(15),
  -> price int(6),
  -> miles_ridden int(6),
  -> primary key (name)
  -> );
Query OK, 0 rows affected (0.11 sec)

mysql> insert into celestebikes
  -> select bikename, color, cost, mileage
  -> from bikes
  -> where color='celeste';
Query OK, 2 rows affected (0.03 sec)
Records: 2 Duplicates: 0 Warnings: 0

mysql> select * from celestebikes;
+-----+-----+-----+-----+
| name          | paint  | price | miles_ridden |
+-----+-----+-----+-----+
| Bianchi Corse Evo 4 | celeste | 5700  | 300          |
| Bianchi Evolution 3 | celeste | 4800  | 2000         |
+-----+-----+-----+-----+
2 rows in set (0.00 sec)

mysql> _
```

Create an initially empty table with a schema different from the base table.

Using Form 3 for insertion

This table contains the those bike tuples whose color was celeste from the source table.

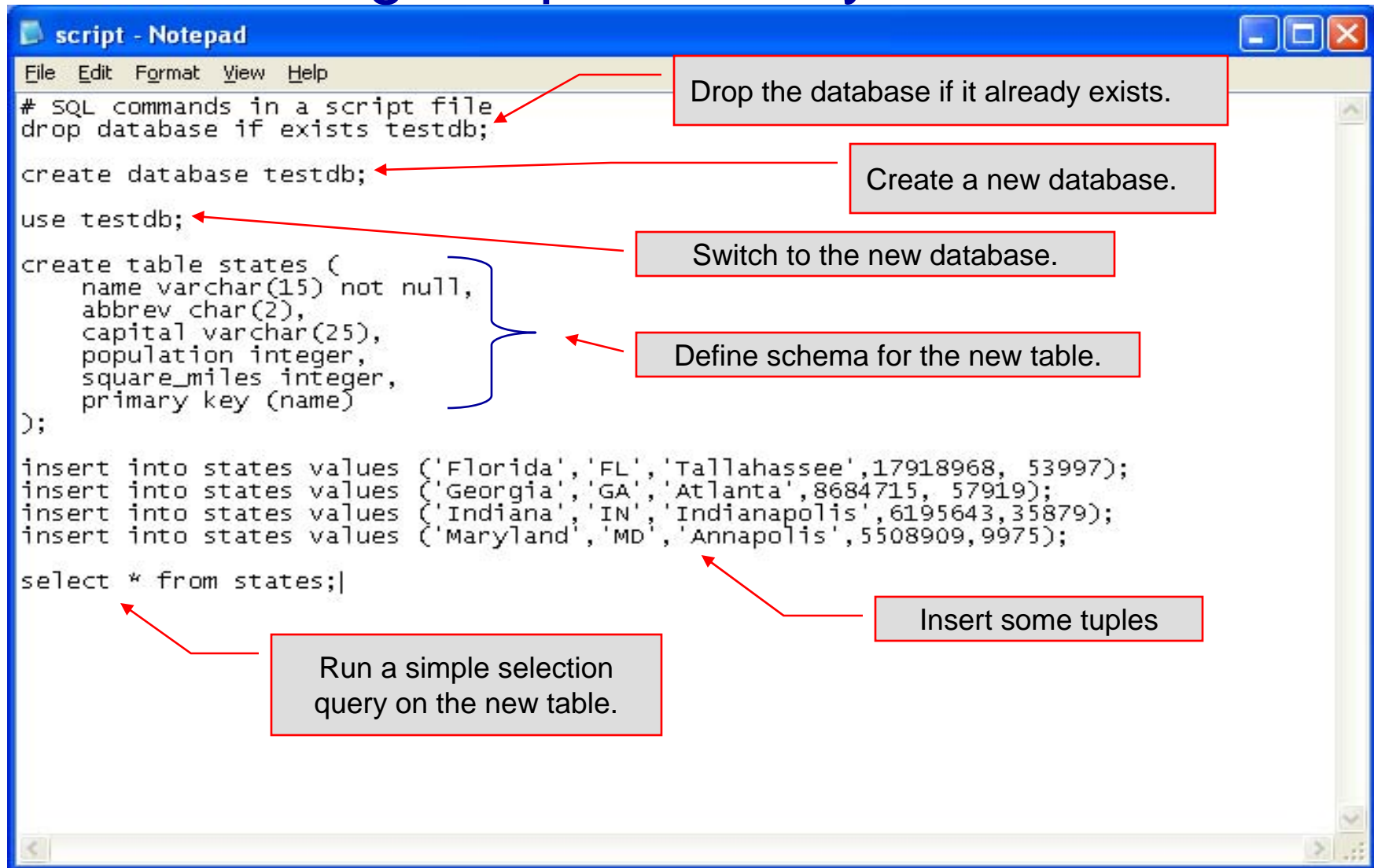


Using Scripts with MySQL

- Entering data to create sample databases using conventional SQL commands is tedious and prone to errors. A much simpler technique is to use scripts. The following illustrates two techniques for invoking scripts in MySQL.
- Create your script file using the text editor of your choice.
- Comments in the SQL script files begin with a # symbol.
- In the script file example shown on the next slide, I drop the database in the first SQL command. Without the if exists clause, this will generate an error if the database does not exist. The first time the script executes (or subsequent executions if the database is dropped independently) the error will be generated...simply ignore the error.



Using Scripts with MySQL (cont.)



The screenshot shows a Notepad window with a MySQL script. Red arrows point from text boxes to specific lines in the script:

- Drop the database if it already exists.** points to `drop database if exists testdb;`
- Create a new database.** points to `create database testdb;`
- Switch to the new database.** points to `use testdb;`
- Define schema for the new table.** points to the `create table states` block.
- Insert some tuples** points to the `insert into states values` block.
- Run a simple selection query on the new table.** points to `select * from states;`

```
# SQL commands in a script file
drop database if exists testdb;

create database testdb;

use testdb;

create table states (
    name varchar(15) not null,
    abbrev char(2),
    capital varchar(25),
    population integer,
    square_miles integer,
    primary key (name)
);

insert into states values ('Florida','FL','Tallahassee',17918968, 53997);
insert into states values ('Georgia','GA','Atlanta',8684715, 57919);
insert into states values ('Indiana','IN','Indianapolis',6195643,35879);
insert into states values ('Maryland','MD','Annapolis',5508909,9975);

select * from states;
```



Using Scripts with MySQL (cont.)

```
MySQL Command Line Client
mysql> show databases;
+-----+
| Database |
+-----+
| information_schema |
| bikedb      |
| mysql      |
| sample     |
| test       |
+-----+
5 rows in set (0.00 sec)

mysql> source e:\courses\cop 4710 - database systems\spring 2006\script.sql
Query OK, 0 rows affected, 1 warning (0.00 sec)

Query OK, 1 row affected (0.00 sec)

Database changed
Query OK, 0 rows affected (0.14 sec)

Query OK, 1 row affected (0.02 sec)

Query OK, 1 row affected (0.03 sec)

Query OK, 1 row affected (0.01 sec)

Query OK, 1 row affected (0.02 sec)

+-----+-----+-----+-----+-----+
| name      | abbrev | capital      | population | square_miles |
+-----+-----+-----+-----+-----+
| Florida   | FL     | Tallahassee | 17918968   | 53997         |
| Georgia   | GA     | Atlanta      | 8684715    | 57919         |
| Indiana   | IN     | Indianapolis  | 6195643    | 35879         |
| Maryland  | MD     | Annapolis    | 5508909    | 9975          |
+-----+-----+-----+-----+-----+
4 rows in set (0.00 sec)

mysql>
```

Specify which script to execute

Results of select query at end of script.



Importing Data Using the `mysqlimport` Utility

- As with many things in MySQL there are several ways to accomplish a specific task. For getting data into tables, the `mysqlimport` utility is also useful.
- The `mysqlimport` utility reads a range of data formats, including comma- and tab- delimited, and inserts the data into a specified database table. The syntax for `mysqlimport` is:

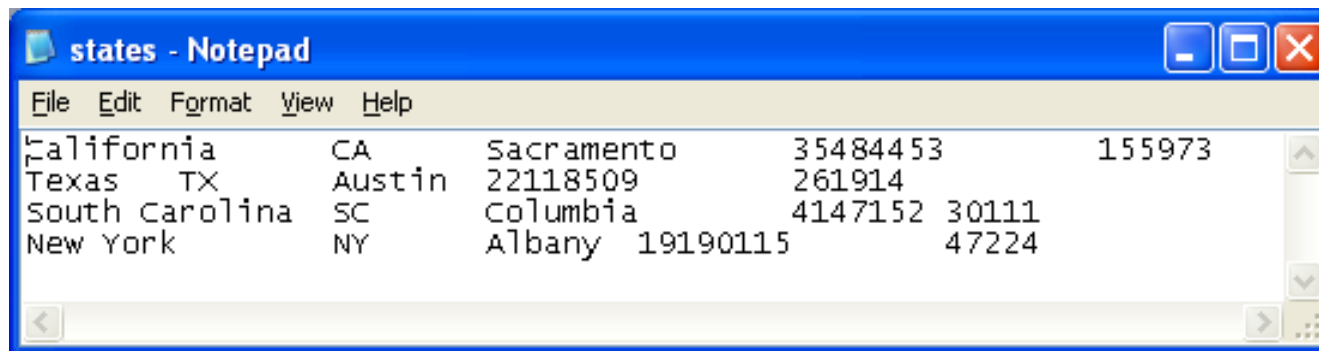
```
mysqlimport [options] database_name file1 file2 ...
```

- This utility is designed to be invoked from the command line.
- The name of the file (excluding the extension) must match the name of the database table into which the data import will occur. Failure to match names will result in an error.



Importing Data Using the `mysqlimport` Utility (cont.)

- The file shown below was created to import additional data into the `states` table within the `testdb` database used in the previous example.



```
states - Notepad
File Edit Format View Help
California CA Sacramento 35484453 155973
Texas TX Austin 22118509 261914
South Carolina SC Columbia 4147152 30111
New York NY Albany 19190115 47224
```

- In this case, the default field delimiter (tab), default field enclosure (nothing), and the default line delimiter (`\n`) were used. Many options are available and are illustrated in the table on pages 65-66.



Importing Data Using the mysqlimportUtility

```
C:\ Command Prompt (2)

mysql> show databases;
+-----+
| Database |
+-----+
| bikedb   |
| mysql    |
| prog3    |
| test     |
| testdb   |
+-----+
5 rows in set (0.00 sec)

mysql> use testdb;
Database changed
mysql> show tables
-> ;
+-----+
| Tables_in_testdb |
+-----+
| states            |
+-----+
1 row in set (0.00 sec)

mysql> exit
Bye

C:\Program Files\MySQL 4.1.9\MySQL Server 4.1\bin>mysqlimport -u root -p -vr tes
tdb c:/states.sql
Enter password: ****
Connecting to localhost
Selecting database testdb
Loading data from SERVER file: c:/states.sql into states
testdb.states: Records: 4 Deleted: 0 Skipped: 0 Warnings: 0
Disconnecting from localhost

C:\Program Files\MySQL 4.1.9\MySQL Server 4.1\bin>
```

Importing a "data
file" into a
MySQL database
table using the
mysqlimport
utility

See tables
on pages 23-
24 for listing
of options.

Table updated



Importing Data Using the mysqlimportUtility

```
C:\ Command Prompt (2) - mysql -u root -p

mysql> select * from states;
+-----+-----+-----+-----+-----+
| name      | abbrev | capital    | population | square_miles |
+-----+-----+-----+-----+-----+
| Florida   | FL     | Tallahassee | 17019068   | 53997         |
| Georgia   | GA     | Atlanta      | 8684715    | 57919         |
| Indiana   | IN     | Indianapolis  | 6195643    | 35870         |
| Maryland  | MD     | Annapolis    | 5508909    | 9775          |
+-----+-----+-----+-----+-----+
4 rows in set (0.00 sec)

mysql> select * from states;
+-----+-----+-----+-----+-----+
| name      | abbrev | capital    | population | square_miles |
+-----+-----+-----+-----+-----+
| Florida   | FL     | Tallahassee | 17019068   | 53997         |
| Georgia   | GA     | Atlanta      | 8684715    | 57919         |
| Indiana   | IN     | Indianapolis  | 6195643    | 35870         |
| Maryland  | MD     | Annapolis    | 5508909    | 9775          |
| South Carolina | SC     | Columbia    | 4147152    | 30111         |
| Texas     | TX     | Austin      | 22118509   | 261914        |
| California | CA     | Sacramento   | 35484453   | 155973        |
| New York  | NY     | Albany      | 19190115   | 47224         |
+-----+-----+-----+-----+-----+
8 rows in set (0.00 sec)

mysql>
```

Table **before**
another client
updated the table
using the
mysqlimport utility.

Table **after** another
client updated the
table using the
mysqlimport utility.



mysqlimportUtility Options

Option	Action
-r or --replace	Causes imported rows to overwrite existing rows if they have the same unique key value.
-i or --ignore	Ignores rows that have the same unique key value as existing rows.
-f or --force	Forces mysqlimport to continue inserting data even if errors are encountered.
-l or --lock	Lock each table before importing (a good idea in general and especially on a busy server).
-d or --delete	Empty the table before inserting data.
--fields-terminated-by='char'	Specify the separator used between values of the same row, default \t (tab).
--fields-enclosed-by='char'	Specify the delimiter that encloses each field, default is none.



mysqlimport Utility Options (cont.)

Option	Action
--fields-optionally-enclosed-by='char'	Same as --fields-enclosed-by, but delimiter is used only to enclosed string-type columns, default is none.
--fields-escaped-by='char'	Specify the escape character placed before special characters; default is \.
--lines-terminated-by='char'	Specify the separator used to terminate each row of data, default is \n (newline).
-u or --user	Specify your username
-p or --password	Specify your password
-h or --host	Import into MySQL on the named host; default is localhost.
-s or --silent	Silent mode, output appears only when errors occur.
-v or --verbose	Verbose mode, print more commentary on action.
-? or --help	Print help message and exit



Importing Data From A File With SQL

Statement Load Data Infile

- Using the utility `mysqlimport` to load data into a table from an external file works well if the user has access to a command window or command line.
- If you have access via a connection to only the MySQL database, or you are importing data from within an executing application, you will need to use the SQL statement `Load Data Infile`.
- The `Load Data Infile` statement also provides a bit more flexibility since the file name does not need to match the table name. Other than that the options are basically the same and the same results are accomplished.
- The example on page 70 illustrates this SQL command which is available in MySQL.



Importing Data From A File With SQL

Statement Load Data Infile (cont.)

- The basic form of the Load Data Infile statement is:

```
LOAD DATA [LOW_PRIORITY | CONCURRENT] [LOCAL] INFILE 'filename'  
[REPLACE | IGNORE]  
INTO TABLE tablename  
[FIELDS  
    [TERMINATED BY 'char']  
    [ [OPTIONALLY] ENCLOSED BY 'char' ]  
    [ESCAPED BY '\char' ]  
[LINES  
    [STARTING BY 'char']  
    [TERMINATED BY 'char' ]  
[IGNORE number LINES]  
[(column_name, ... )]
```

Either allow concurrent update or block until no other clients are reading from the specified table. See page 75.

Same as `-r` and `-i` options in `mysqlimport` utility – either replace or ignore rows with duplicate keys.

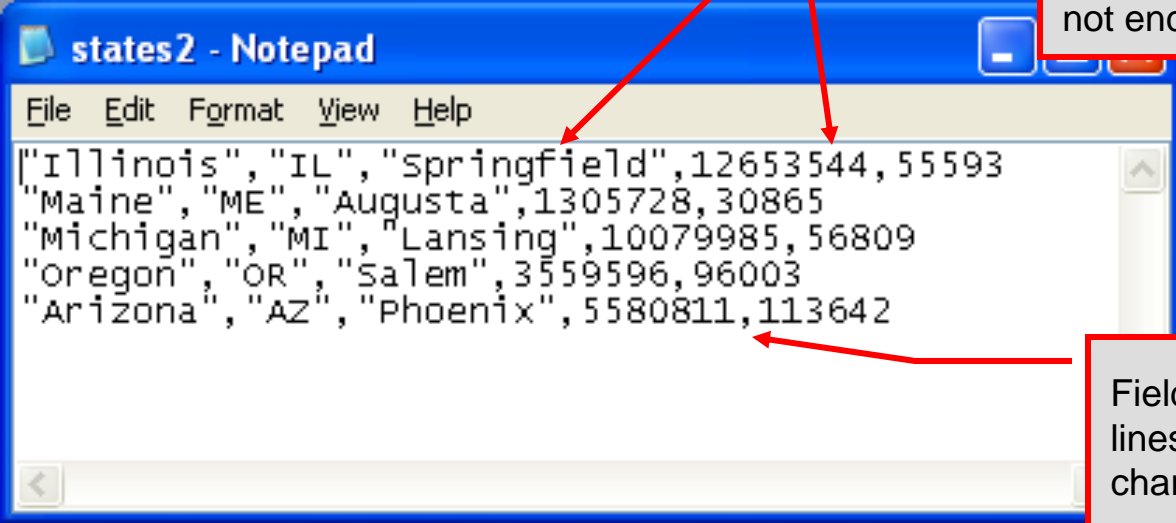
Sets the characters that delimit and enclose the fields and lines in the data file. Similar to `mysqlimport` syntax.

Ignores lines at the start of the file (miss header info)

Used to load only certain columns (not entire rows)



Load Data Infile Example



String fields are enclosed by double quotes in this file. Numeric values are not enclosed in quotes.

```
"Illinois","IL","springfield",12653544,55593
"Maine","ME","Augusta",1305728,30865
"Michigan","MI","Lansing",10079985,56809
"Oregon","OR","Salem",3559596,96003
"Arizona","AZ","Phoenix",5580811,113642
```

Fields are delimited by commas and lines are terminated by newline characters (an invisible \n)

Text file containing the data to be loaded into the database table.



mysql> select * from states;

name	abbrev	capital	population	square_miles
Florida	FL	Tallahassee	17019068	53997
Georgia	GA	Atlanta	8684715	57919
Indiana	IN	Indianapolis	6195643	35870
Maryland	MD	Annapolis	5508909	9775
California	CA	Sacramento	35484453	155973
Texas	TX	Austin	22118509	261914
South Carolina	SC	Columbia	4147152	30111
New York	NY	Albany	19190115	47224

8 rows in set (0.00 sec)

```
mysql> load data infile 'states2.sql'
-> into table states
-> fields
-> terminated by ','
-> optionally enclosed by '"'
-> ;
```

Query OK, 5 rows affected (0.02 sec)
Records: 5 Deleted: 0 Skipped: 0 Warnings: 0

mysql> select * from states;

name	abbrev	capital	population	square_miles
Florida	FL	Tallahassee	17019068	53997
Georgia	GA	Atlanta	8684715	57919
Indiana	IN	Indianapolis	6195643	35870
Maryland	MD	Annapolis	5508909	9775
California	CA	Sacramento	35484453	155973
Texas	TX	Austin	22118509	261914
South Carolina	SC	Columbia	4147152	30111
New York	NY	Albany	19190115	47224
Illinois	IL	Springfield	12653544	55593
Maine	ME	Augusta	1305728	30865
Michigan	MI	Lansing	10079985	56809
Oregon	OR	Salem	3559596	96003
Arizona	AZ	Phoenix	5580811	113642

13 rows in set (0.00 sec)

mysql>

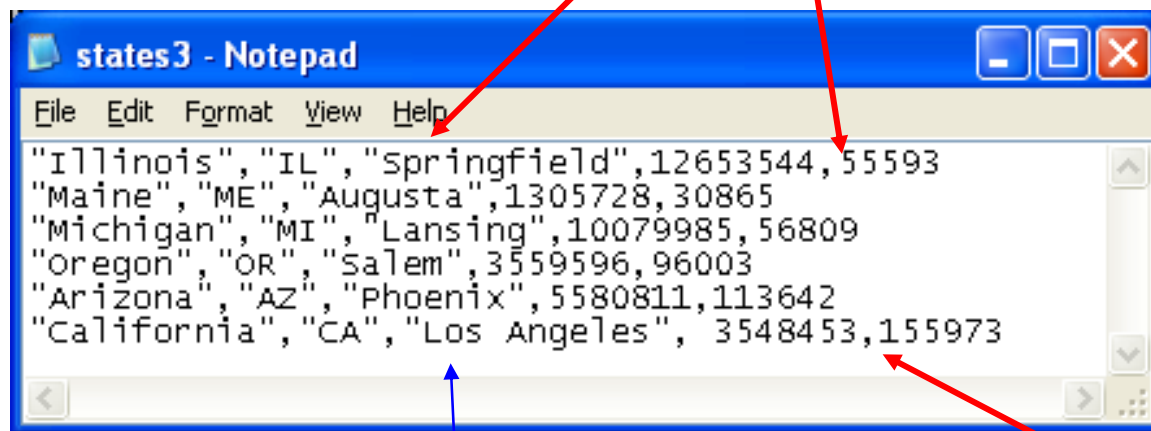
States table **before**
addition of data

Load data infile statement indicating
all of the parameters which
describe the configuration of the
input file.

States table **after**
addition of data



Load Data Infile Example 2



```
states3 - Notepad
File Edit Format View Help
"Illinois","IL","Springfield",12653544,55593
"Maine","ME","Augusta",1305728,30865
"Michigan","MI","Lansing",10079985,56809
"Oregon","OR","Salem",3559596,96003
"Arizona","AZ","Phoenix",5580811,113642
"California","CA","Los Angeles", 3548453,155973
```

String fields are enclosed by double quotes in this file. Numeric values are not enclosed in quotes.

Text file containing the data to be loaded into the database table.

California already exists in the states table – this one will replace the value of the capital with a different value.

Fields are delimited by commas and lines are terminated by newline characters (an invisible \n)



Database changed

mysql> select * from states;

name	abbrev	capital	population	square_miles
Florida	FL	Tallahassee	17019068	53997
Georgia	GA	Atlanta	8684715	57919
Indiana	IN	Indianapolis	6195643	35870
Maryland	MD	Annapolis	5508909	9775
California	CA	Sacramento	35484453	155973
Texas	TX	Austin	22118509	261914
South Carolina	SC	Columbia	4147152	30111
New York	NY	Albany	19190115	47224

8 rows in set (0.00 sec)

```
mysql> load data infile 'states3.sql'
-> replace into table states
-> fields
-> terminated by ','
-> optionally enclosed by '"'
-> ;
```

Query OK, 7 rows affected (0.02 sec)

Records: 6 Deleted: 1 Skipped: 0 Warnings: 0

mysql> select * from states;

name	abbrev	capital	population	square_miles
Florida	FL	Tallahassee	17019068	53997
Georgia	GA	Atlanta	8684715	57919
Indiana	IN	Indianapolis	6195643	35870
Maryland	MD	Annapolis	5508909	9775
California	CA	Los Angeles	3548453	155973
Texas	TX	Austin	22118509	261914
South Carolina	SC	Columbia	4147152	30111
New York	NY	Albany	19190115	47224
Illinois	IL	Springfield	12653544	55593
Maine	ME	Augusta	1305728	30865
Michigan	MI	Lansing	10079985	56809
Oregon	OR	Salem	3559596	96003
Arizona	AZ	Phoenix	5580811	113642

13 rows in set (0.00 sec)

mysql>

States table **before** addition of data

Same basic configuration as in previous example except that we have instructed MySQL to replace duplicate key value rows with new values (in this case replacing California's capital).

States table **after** addition of data. Note that California's capital has been changed!



States table **before**
addition of data

CA Command Prompt (2) - mysql -u root -p

```
mysql> select * from states;
```

name	abbrev	capital	population	square_miles
Florida	FL	Tallahassee	17019068	53997
Georgia	GA	Atlanta	8684715	57919
Indiana	IN	Indianapolis	6195643	35870
Maryland	MD	Annapolis	5508909	9775
California	CA	Los Angeles	3548453	155973
Texas	TX	Austin	22118509	261914
South Carolina	SC	Columbia	4147152	30111
New York	NY	Albany	19190115	47224
Illinois	IL	Springfield	12653544	55593
Maine	ME	Augusta	1305728	30865
Michigan	MI	Lansing	10079985	56809
Oregon	OR	Salem	3559596	96003
Arizona	AZ	Phoenix	5580811	113642

```
13 rows in set (0.00 sec)
```

```
mysql> load data infile 'states3.sql'
```

```
-> replace into table states
```

```
-> fields
```

```
-> terminated by ','
```

```
-> optionally enclosed by '"'
```

```
-> ;
```

```
Query OK, 12 rows affected (0.00 sec)
```

```
Records: 6 Deleted: 6 Skipped: 0 Warnings: 0
```

```
mysql>
```

Notice that running the same command on the altered table produced a different set of statistics, since all six key values appear in the infile, their corresponding values in the table are deleted and re-entered using the "new" data.



The Ignore Clause of the Insert Command

- While the normal issues of data type compatibility are always of concern, there are other issues to deal with when inserting data into tables.
- There is the possibility that a duplicate of a key may be entered. If so, you will see an error like this:

```
ERROR 1062: Duplicate entry '2' for key 1
```

- It is possible to subdue errors by using the keyword `ignore` in the `insert` statement. By using `ignore` any duplicate rows will simply be ignored. They won't be imported, and the data at the related row of the target table will be left untouched.
 - In your application, you would be wise to check how many rows were affected (imported) whenever using `ignore` because ignoring a record may constitute a failure condition in your application that needs to be handled.



Low Priority and Delayed Inserts

- If you specify `insert low-priority`, the insert waits until all other clients have finished reading from the table before the insert is executed.
- If you specify `insert delayed`, the client performing the action gets an instant acknowledgement that the insert has been performed, although in fact the data will only be inserted when the table is not in use by another thread.
 - This may be useful if you have an application that needs to complete its process in minimum time, or simply where there is no need for it to wait for the effect of an insert to take place. For example, when you're adding data to a log or audit trail.
 - This feature applies only to ISAM or MyISAM type files.



Inserting/Replacing Data Using Replace

- Data can also be entered into a MySQL table using the replace command.
- The replace statement has forms similar to the insert statement:

Form 1 `replace [low priority | delayed] [ignore] [into]table_name
 [set] column_name1 = expression1,
 column_name2 = expression2, ...`

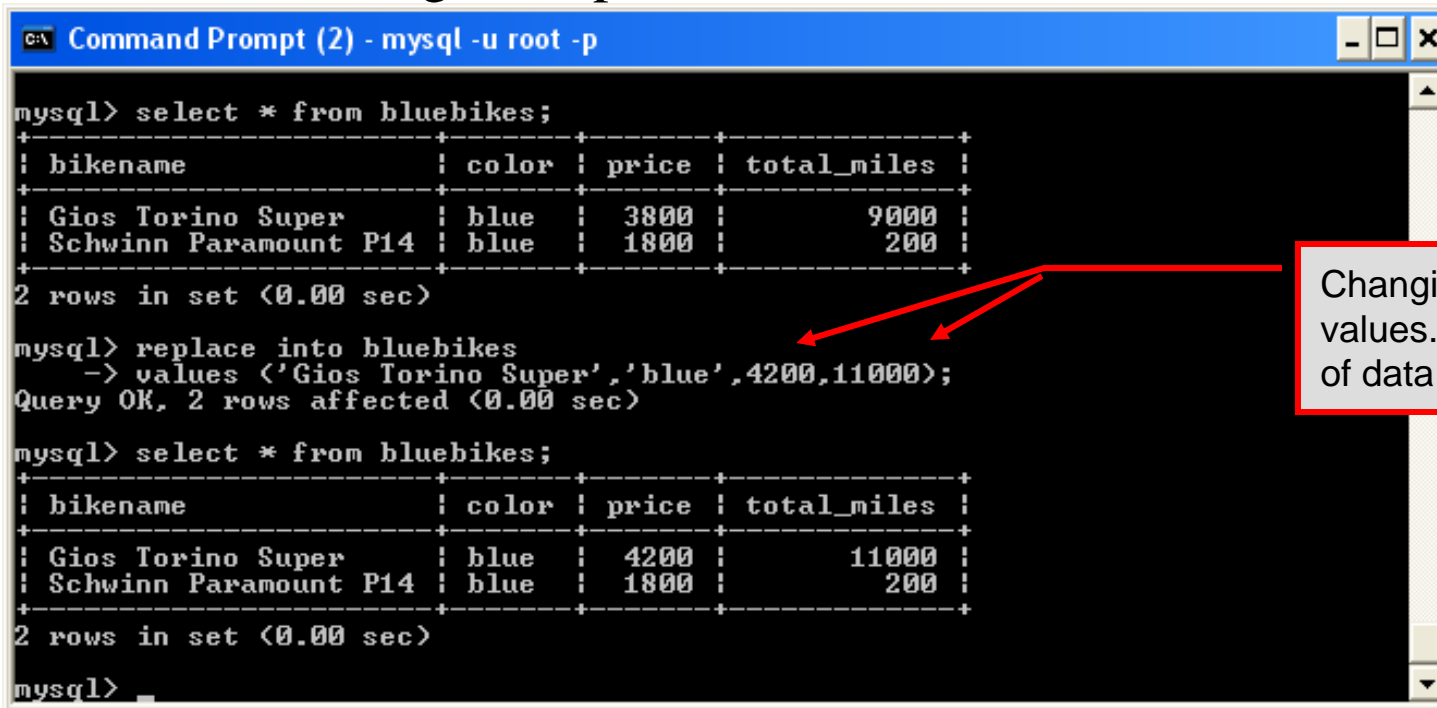
Form 2 `replace [low priority | delayed] [ignore] [into]table_name
 [(column_name,...)]values (expression,...), (...)`

Form 3 `replace [low priority | delayed] [ignore] [into]table_name
 [(column_name,...)] select...`



Using replace

- The replace statement works similar to insert. It always tries to insert the new data, but when it tries to insert a new row with the same primary or unique key as an existing row, it deletes the old row and replaces it with the new values.
- The following examples will illustrate how replace operates.



```
C:\> Command Prompt (2) - mysql -u root -p

mysql> select * from bluebikes;
+-----+-----+-----+-----+
| bikename      | color | price | total_miles |
+-----+-----+-----+-----+
| Gios Torino Super | blue  | 3800  | 9000        |
| Schwinn Paramount P14 | blue  | 1800  | 200         |
+-----+-----+-----+-----+
2 rows in set (0.00 sec)

mysql> replace into bluebikes
-> values ('Gios Torino Super','blue',4200,11000);
Query OK, 2 rows affected (0.00 sec)

mysql> select * from bluebikes;
+-----+-----+-----+-----+
| bikename      | color | price | total_miles |
+-----+-----+-----+-----+
| Gios Torino Super | blue  | 4200  | 11000       |
| Schwinn Paramount P14 | blue  | 1800  | 200         |
+-----+-----+-----+-----+
2 rows in set (0.00 sec)

mysql>
```

Changing non-key values. Simplest form of data replacement.



Using Replace (cont.)

```
C:\ Command Prompt (2) - mysql -u root -p
mysql> select * from bluebikes;
+-----+-----+-----+-----+
| bikename          | color | price | total_miles |
+-----+-----+-----+-----+
| Gios Torino Super | blue  | 4200  | 11000       |
| Schwinn Paramount P14 | blue | 1800  | 200         |
+-----+-----+-----+-----+
2 rows in set (0.00 sec)

mysql> replace into bluebikes
-> values ('Fondriest U107','blue',5300,2200);
Query OK, 1 row affected (0.00 sec)

mysql> select * from bluebikes;
+-----+-----+-----+-----+
| bikename          | color | price | total_miles |
+-----+-----+-----+-----+
| Gios Torino Super | blue  | 4200  | 11000       |
| Schwinn Paramount P14 | blue | 1800  | 200         |
| Fondriest U107    | blue  | 5300  | 2200        |
+-----+-----+-----+-----+
3 rows in set (0.00 sec)

mysql>
```

Specifying values for a non-existent key. Basically the same as an insert since the key value being replaced does not currently exist.



Performing Updates on Tables

- The `update` command allows you to modify the values of the existing data in a table. The basic format of the statement is:

```
update [low priority] [ignore] table_name
    set column_name1 = expression1,
       column_name2 = expression2, ...
    [where where_definition]
    [limit num];
```

- There are basically two parts to the statement: the `set` portion to declare which column to set to what value; and the `where` portion, which defines which rows are to be affected.
- `Limit` restricts the number of rows affected to `num`.



Using update (cont.)

```
CA Command Prompt (2) - mysql -u root -p
mysql> select * from bluebikes;
+-----+-----+-----+-----+
| bikename          | color | price | total_miles |
+-----+-----+-----+-----+
| Gios Torino Super | blue  | 4200  | 11000       |
| Schwinn Paramount P14 | blue  | 1800  | 200         |
| Fondriest U107     | blue  | 5300  | 2200        |
+-----+-----+-----+-----+
3 rows in set (0.01 sec)

mysql> update bluebikes
-> set price=price*1.05;
Query OK, 3 rows affected (0.02 sec)
Rows matched: 3  Changed: 3  Warnings: 0

mysql> select * from bluebikes;
+-----+-----+-----+-----+
| bikename          | color | price | total_miles |
+-----+-----+-----+-----+
| Gios Torino Super | blue  | 4410  | 11000       |
| Schwinn Paramount P14 | blue  | 1890  | 200         |
| Fondriest U107     | blue  | 5565  | 2200        |
+-----+-----+-----+-----+
3 rows in set (0.00 sec)

mysql>
```

Global update within the relation. All tuples have their price field increased by 5%



Using update (cont.)

```
C:\ Command Prompt (2) - mysql -u root -p
mysql> select * from bluebikes;
+-----+-----+-----+-----+
| bikename      | color | price | total_miles |
+-----+-----+-----+-----+
| Gios Torino Super | blue  | 4200  | 11000       |
| Schwinn Paramount P14 | blue  | 1800  | 200         |
| Fondriest U107    | blue  | 5300  | 2200        |
+-----+-----+-----+-----+
3 rows in set (0.00 sec)

mysql> update bluebikes
-> set price = price * 1.05;
-> where price > 4500;
Query OK, 1 row affected (0.00 sec)
Rows matched: 1  Changed: 1  Warnings: 0

mysql> select * from bluebikes;
+-----+-----+-----+-----+
| bikename      | color | price | total_miles |
+-----+-----+-----+-----+
| Gios Torino Super | blue  | 4200  | 11000       |
| Schwinn Paramount P14 | blue  | 1800  | 200         |
| Fondriest U107    | blue  | 5565  | 2200        |
+-----+-----+-----+-----+
3 rows in set (0.00 sec)

mysql>
```

Specific update, only tuples satisfying the select condition (those with price greater than 4500) will have their price field increased by 5%.



Select Queries in MySQL

- The select command in MySQL is basically the same as in the standard SQL, however, it does have some additional features. The basic format of the statement is (not all options are shown – for complete details see the SQL Manual):

```
SELECT [ALL | DISTINCT | DISTINCTROW][HIGH_PRIORITY]
      [STRAIGHT JOIN] [SQL_SMALL_RESULT][SQL_BIG_RESULT]
      [SQL_BUFFER_RESULT][SQL_CACHE | SQL_NO_CACHE]
      select_expression, ...
[INTO {OUTFILE | DUMPFILE} 'path/to/filename' export_options]
[FROM table_references
  WHERE where_definition]
  [GROUP BY {col_name | col_alias | col_pos | formula}
      [asc | desc], ...]
  [HAVING where_definition]
  [ORDER BY {col_name | col_alias | col_pos | formula}
      [asc | desc], ...]
  [LIMIT [offset, ] num_rows]
  [PROCEDURE procedure_name];
```



MySQL RDBMS (cont.)

- MySQL features a user permissions system, which allows control over user's access to the databases under MySQL control.
- There are very few competitors of MySQL (Oracle, Sybase, DB2, and SQL Server) that can match the level of sophistication provided by MySQL's permissions system in terms of granularity and level of security provided.

Note that I did not include Microsoft Access in the list above. There are a couple of reasons for this; Access concentrates on the client front-end, although available in shareable versions, it lacks the management system that is a key part of any RDBMS. Access provides virtually no user authentication capabilities nor does it have multithreading processing capabilities, in its normal form.



Authorization in MySQL

- `mysql` and the various utility programs such as `mysqladmin`, `mysqlshow`, and `mysqlimport` can only be invoked by a valid MySQL user.
- Permissions for various users are recorded in **grant tables** maintained by MySQL.
- As the root user, you have access to all the databases and tables maintained by the MySQL Server.
- One of these databases is named `mysql` and contains the various information on the users who have access to this installation of MySQL. Some of the tables which comprise this database are shown on the next few pages.



Tables in the mysql Database

```
C:\ Command Prompt (2) - mysql -u root -p
Type 'help;' or '\h' for help. Type '\c' to clear the buffer.

mysql> show databases;
+-----+
| Database |
+-----+
| bikedb   |
| mysql    |
| prog3    |
| test     |
| testdb   |
+-----+
5 rows in set (0.01 sec)

mysql> use mysql;
Database changed
mysql> show tables;
+-----+
| Tables_in_mysql |
+-----+
| columns_priv     |
| db               |
| func             |
| help_category    |
| help_keyword     |
| help_relation    |
| help_topic       |
| host             |
| tables_priv      |
| time_zone        |
| time_zone_leap_second |
| time_zone_name   |
| time_zone_transition |
| time_zone_transition_type |
| user             |
| user_info        |
+-----+
16 rows in set (0.00 sec)

mysql>
```

The mysql database contains user information

Details on user privileges at the database level. See page 84.

Specific details on privileges at the table level. See page 83

Details on user privileges. See page 81.

Details about the various users. See page 82.



Contents of the user Table

outt; - Notepad

File Edit Format View Help

```
mysql> use mysql;
Database changed
mysql> describe user;
```

Field	Type	Null	Key	Default	Extra
Host	varchar(60)		PRI		
User	varchar(16)		PRI		
Password	varchar(41)				
Select_priv	enum('N','Y')			N	
Insert_priv	enum('N','Y')			N	
Update_priv	enum('N','Y')			N	
Delete_priv	enum('N','Y')			N	
Create_priv	enum('N','Y')			N	
Drop_priv	enum('N','Y')			N	
Reload_priv	enum('N','Y')			N	
Shutdown_priv	enum('N','Y')			N	
Process_priv	enum('N','Y')			N	
File_priv	enum('N','Y')			N	
Grant_priv	enum('N','Y')			N	
References_priv	enum('N','Y')			N	
Index_priv	enum('N','Y')			N	
Alter_priv	enum('N','Y')			N	
Show_db_priv	enum('N','Y')			N	
Super_priv	enum('N','Y')			N	
Create_tmp_table_priv	enum('N','Y')			N	
Lock_tables_priv	enum('N','Y')			N	
Execute_priv	enum('N','Y')			N	
Repl_slave_priv	enum('N','Y')			N	
Repl_client_priv	enum('N','Y')			N	
ssl_type	enum('', 'ANY', 'X509', 'SPECIFIED')				
ssl_cipher	blob				
x509_issuer	blob				
x509_subject	blob				
max_questions	int(11) unsigned			0	
max_updates	int(11) unsigned			0	
max_connections	int(11) unsigned			0	

31 rows in set (0.00 sec)



Contents of the user_info Table

```
C:\ Command Prompt (2) - mysql -u root -p
16 rows in set (0.00 sec)
mysql> describe user_info;
+-----+-----+-----+-----+-----+-----+
| Field          | Type          | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+-----+
| User           | varchar(16)   |      | PRI |          |       |
| Full_name      | varchar(60)   | YES  | MUL | NULL    |       |
| Description     | varchar(255)  | YES  |     | NULL    |       |
| Email          | varchar(80)   | YES  |     | NULL    |       |
| Contact_information | text         | YES  |     | NULL    |       |
| Icon           | blob          | YES  |     | NULL    |       |
+-----+-----+-----+-----+-----+-----+
6 rows in set (0.00 sec)
mysql>
```



Contents of the tables_priv Table

```
mysql> \t;
mysql> describe tables_priv;
+-----+-----+
| Field | Type |
+-----+-----+
| Host  | char(60) |
| Db    | char(64) |
| User  | char(16) |
| Table_name | char(64) |
| Grantor | char(77) |
| Timestamp | timestamp |
| Table_priv | set('Select','Insert','Update','Delete','Create','Drop','Grant','References','Index','Alter') |
| Column_priv | set('Select','Insert','Update','References') |
+-----+-----+
8 rows in set (0.00 sec)
```

```
mysql> show tables;
+-----+
| Tables_in_test |
+-----+
| tables_priv     |
+-----+

mysql> describe tables_priv;
+-----+-----+-----+-----+-----+
| Field | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+
| Host  |      | PRI |          |      |
| Db    |      | PRI |          |      |
| User  |      | PRI |          |      |
| Table_name |      | PRI |          |      |
| Grantor |      | MUL |          |      |
| Timestamp | YES |     | CURRENT_TIMESTAMP |      |
| Table_priv |      |     |          |      |
| Column_priv |      |     |          |      |
+-----+-----+-----+-----+-----+
1 row in set (0.00 sec)
```



Contents of the db Table

```
C:\ Command Prompt (2) - mysql -u root -p
6 rows in set (0.00 sec)
mysql> describe db;
+-----+-----+-----+-----+-----+-----+
| Field                | Type          | Null | Key | Default | Extra |
+-----+-----+-----+-----+-----+-----+
| Host                 | char(60)      |      | PRI |          |       |
| Db                   | char(64)      |      | PRI |          |       |
| User                 | char(16)      |      | PRI |          |       |
| Select_priv          | enum('N','Y') |      |      | Z        |       |
| Insert_priv          | enum('N','Y') |      |      | Z        |       |
| Update_priv          | enum('N','Y') |      |      | Z        |       |
| Delete_priv          | enum('N','Y') |      |      | Z        |       |
| Create_priv          | enum('N','Y') |      |      | Z        |       |
| Drop_priv            | enum('N','Y') |      |      | Z        |       |
| Grant_priv           | enum('N','Y') |      |      | Z        |       |
| References_priv      | enum('N','Y') |      |      | Z        |       |
| Index_priv           | enum('N','Y') |      |      | Z        |       |
| Alter_priv           | enum('N','Y') |      |      | Z        |       |
| Create_tmp_table_priv | enum('N','Y') |      |      | Z        |       |
| Lock_tables_priv     | enum('N','Y') |      |      | Z        |       |
+-----+-----+-----+-----+-----+-----+
15 rows in set (0.00 sec)
mysql>
```



How The Grant Tables Work

- The various grant tables work together to define access capabilities for the various users of the databases in MySQL. The tables represent a hierarchy which begins at the database level and moves downward to finer and finer granularity in access capabilities.
- To understand how the grant tables work, it is necessary to understand the process that MySQL goes through when considering a request from a client.

Step 1: A user attempts to connect to the MySQL server. The user table is consulted, and on the basis of the username, password, and host from which the connection is occurring, the connection is either refused or accepted. (MySQL actually sorts the user table and looks for the first match.)



How The Grant Tables Work (cont.)

Step 2: If the connection is accepted, any privilege fields in the `user` table that are set to 'Y' will allow the user to perform that action on any database under the server's control. For administrative actions such as shutdown and reload, the entry in the `user` table is deemed absolute, and no further grant tables are consulted.

Step 3: Where the user makes a database-related request and the `user` table does not allow the user to perform that operations (the privilege is set to 'N'), MySQL consults the `db` table (see page 84).

Step 4: The `db` table is consulted to see if there is an entry for the user, database, and host. If there is a match, the `db` privilege fields determine whether the user can perform the request.



How The Grant Tables Work (cont.)

Step 5: If there is a match on the `db` table's `Db` and `User` files but `Host` is blank, the `host` table is consulted to see whether there is a match on all three fields. If there is, the privilege fields in the `host` table will determine whether the use can perform the requested operation. Corresponding entries in the `db` and `host` tables must both be 'Y' for the request to be granted. Thus, an 'N' in either table will block the request.

Step 6: If the user's request is not granted, MySQL checks the `tables_priv` (see page 83) and `columns_priv` tables. It looks for a match on the user, host, database, and table to which the request is made (and the column, if there is an entry in the `columns_priv` table). It adds any privileges it finds in these tables to the privileges already granted. The sum of these privileges determines if the request can be granted.



Managing User Privileges with GRANT and REVOKE

- The basic granting and revocation of privileges in MySQL are accomplished through the `grant` and `revoke` commands.
- The format of the `grant` command is:

```
GRANT privileges [(column_list)]  
ON database_name.table_name  
TO username@hostname [IDENTIFIED BY 'password']  
[REQUIRE [SSL | X509]  
    [CIPHER cipher [AND] ]  
    [ISSUER issuer [AND] ]  
    [SUBJECT subject ] ]  
[WITH GRANT OPTION |  
    MAX_QUERIES_PER_HOUR num |  
    MAX_UPDATES_PER_HOUR num |  
    MAX_CONNECTIONS_PER_HOUR num ]
```



Some of the Privileges Assigned with GRANT

Privilege	Operations Permitted
ALL or ALL PRIVILEGES	All privileges except for GRANT
ALTER	Change a table definition using ALTER TABLE excluding the creation and dropping of indices.
CREATE	Create database or tables within a database.
CREATE TEMPORARY TABLES	Create temporary tables.
DELETE	Ability to perform deletions from tables. (Delete DML statements).
DROP	Ability to drop databases or tables.
INSERT	Ability to insert data into tables.
SHUTDOWN	Ability to shutdown the MySQL server.



Displaying Privileges with SHOW

- The SQL command SHOW is used to display the grant privileges for a given user.
- The syntax for the SHOW command is:

SHOW GRANTS FOR *username@hostname*

- An example is shown below:

```
outt; - Notepad
File Edit Format View Help

mysql> \t;
mysql> show grants for mark@localhost;
+-----+
| Grants for mark@localhost |
+-----+
| GRANT USAGE ON *.* TO 'mark'@'localhost' IDENTIFIED BY PASSWORD '*E6ACCEDB2495496B191ED488F598F04239' |
| GRANT SELECT ON `testdb`.* TO 'mark'@'localhost' |
| GRANT ALL PRIVILEGES ON `mysql`.`bikes` TO 'mark'@'localhost' |
+-----+
3 rows in set (0.00 sec)

mysql> \t;
```

This user has only SELECT privilege on the testdb database.

The user has all privileges on the bikes and mysql databases.



Revoking User Privileges with REVOKE

- Revocation of privileges in MySQL is accomplished with the revoke command.
- The format of the revoke command is:

```
REVOKE privileges [(column_list)]  
ON database_name.table_name  
FROM username@hostname
```

- An example is shown on the next page.



Example - Revoking User Privileges with REVOKE

```
outtt; - Notepad
File Edit Format View Help
mysql> show grants for mark@localhost;
+-----+
| Grants for mark@localhost |
+-----+
| GRANT USAGE ON *.* TO 'mark'@'localhost' IDENTIFIED BY PASSWORD '*E6ACCEDB2495496B191ED488F598F04239C85E73' |
| GRANT ALL PRIVILEGES ON `mysql`.`bikes` TO 'mark'@'localhost' |
| GRANT SELECT ON `testdb`.`states` TO 'mark'@'localhost' |
+-----+
3 rows in set (0.00 sec)

mysql> revoke select
-> on testdb.states
-> from mark@localhost;
Query OK, 0 rows affected (0.00 sec)

mysql> show grants for mark@localhost;
+-----+
| Grants for mark@localhost |
+-----+
| GRANT USAGE ON *.* TO 'mark'@'localhost' IDENTIFIED BY PASSWORD '*E6ACCEDB2495496B191ED488F598F04239C85E73' |
| GRANT ALL PRIVILEGES ON `mysql`.`bikes` TO 'mark'@'localhost' |
+-----+
2 rows in set (0.00 sec)

mysql> \t;
```

User has SELECT privilege on testdb.states table.

Revoking user's SELECT privilege on testdb.states.

User's grant listing shows that they no longer have SELECT privilege on testdb.states table.

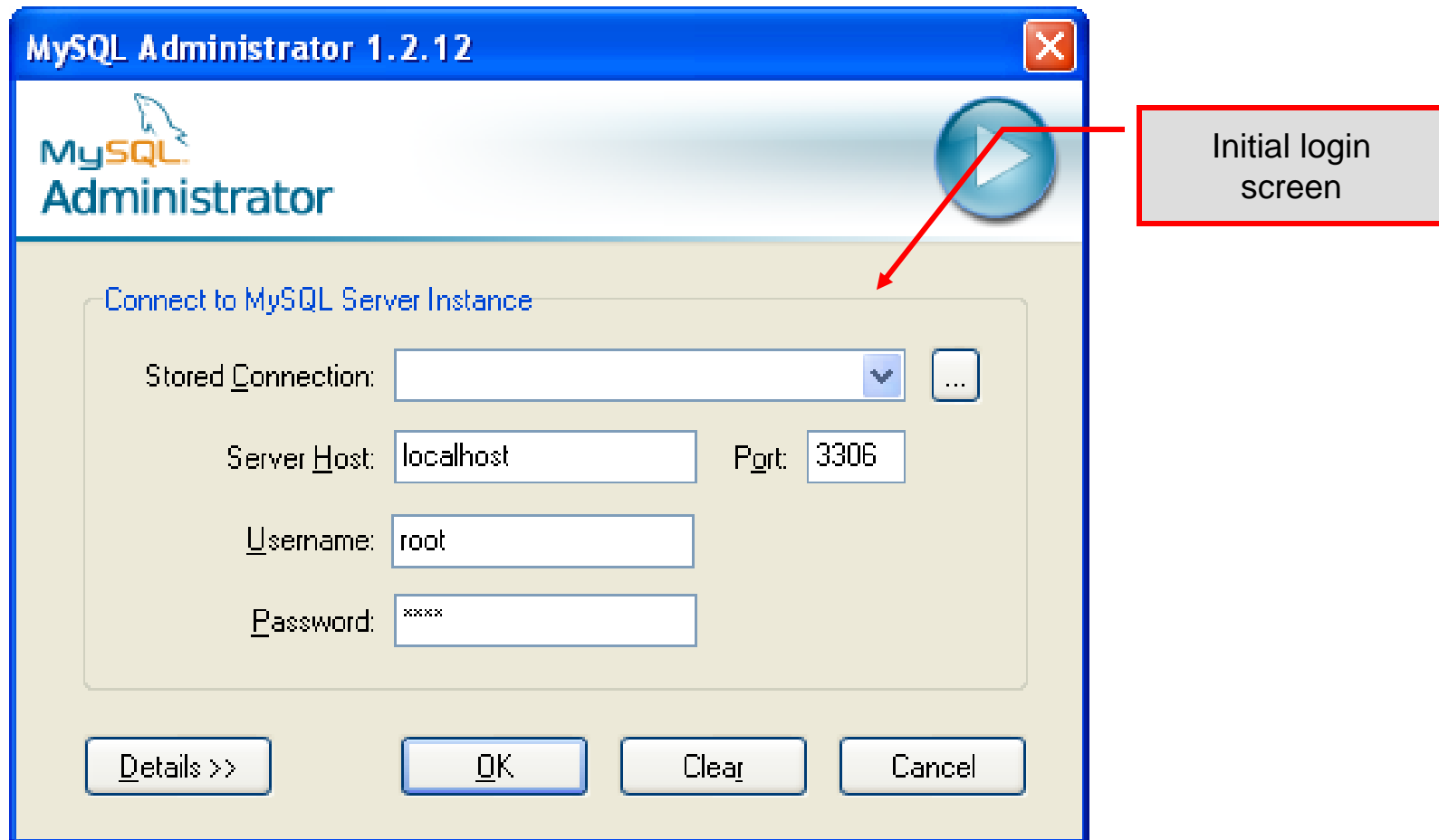


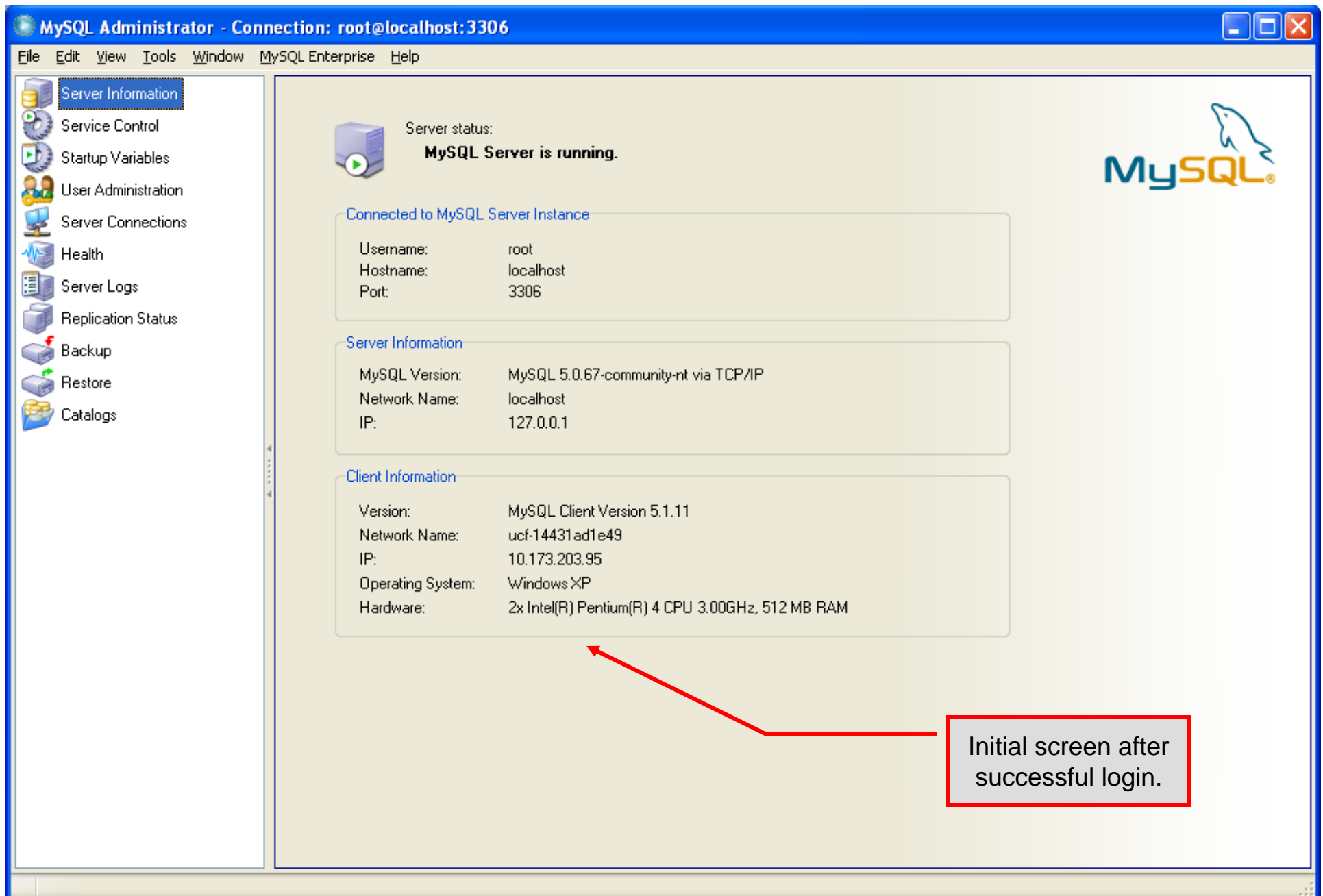
The MySQL Administrator Tool

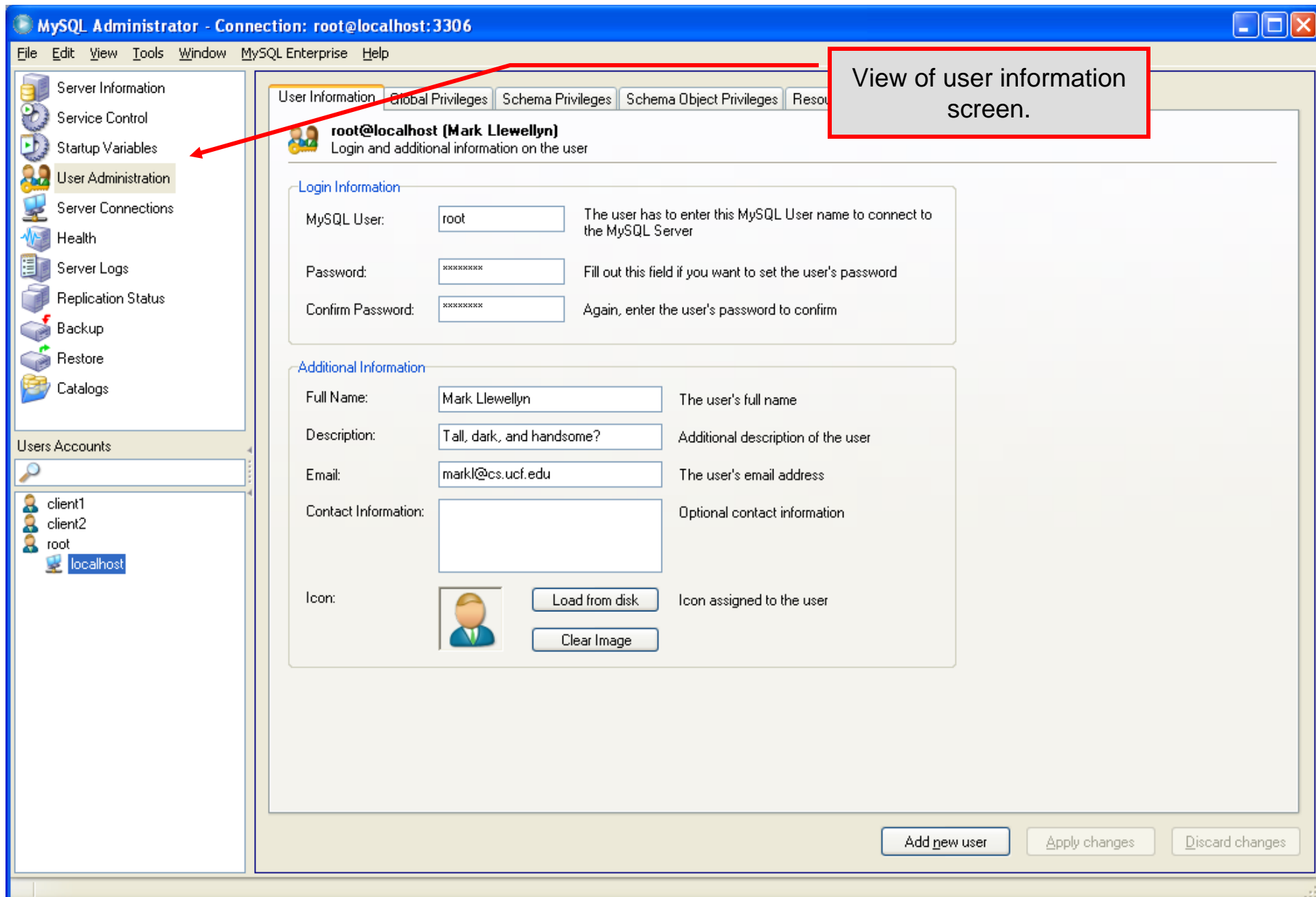
- From MySQL you can download a GUI-based administrator tool to help you administer your MySQL databases.
- This tool implements all of the GRANT, REVOKE, and SHOW functionality available in SQL.
- This tool also contains some system administrator functionality for monitoring system resources and utilization.
- You can download this tool at:
<http://www.mysql.com/products/>.
- A few screen shots of this tool and its capabilities are shown in the next few slides.



The MySQL Administrator Tool – Screen Shots







MySQL Administrator - Connection: root@localhost:3306

File Edit View Tools Window MySQL Enterprise Help

Server Information
Service Control
Startup Variables
User Administration
Server Connections
Health
Server Logs
Replication Status
Backup
Restore
Catalogs

Users Accounts

client1
client2
root
localhost

User Information Global Privileges **Schema Privileges** Schema Object Privileges

root@localhost (Mark Llewellyn)
Schema Privileges assigned to the User

View of user privileges for root user on bikedb

Schemata

bikedb
colorsurvey
guestbook
information__schema
mailinglist
mysql
prog3
sample
test

Assigned Privileges

Available Privileges

SELECT	Grants the SELECT privilege to the user
INSERT	Grants the INSERT privilege to the user
UPDATE	Grants the UPDATE privilege to the user
DELETE	Grants the DELETE privilege to the user
CREATE	Grants the CREATE privilege to the user
DROP	Grants the DROP privilege to the user
GRANT	Grants the GRANT privilege to the user
REFERENCES	Grants the REFERENCES privilege to the user
INDEX	Grants the INDEX privilege to the user
ALTER	Grants the ALTER privilege to the user
CREATE_TMP_T...	Grants the CREATE_TMP_TABLE privilege to the user
LOCK_TABLES	Grants the LOCK_TABLES privilege to the user
CREATE_VIEW	Grants the CREATE_VIEW privilege to the user
SHOW_VIEW	Grants the SHOW_VIEW privilege to the user
CREATE_ROUTINE...	Grants the CREATE_ROUTINE privilege to the user
ALTER_ROUTINE	Grants the ALTER_ROUTINE privilege to the user
EXECUTE	Grants the EXECUTE privilege to the user

Add new user Apply changes Discard changes



MySQL Administrator - Connection: root@localhost:3306

File Edit View Tools Window MySQL Enterprise Help

Server Information
Service Control
Startup Variables
User Administration
Server Connections
Health
Server Logs
Replication Status
Backup
Restore
Catalogs

Users Accounts

client1
client2
root
localhost

User Information Global Privileges **Schema Privileges** Schema Object Privileges Resources

root@localhost (Mark Llewellyn)
Schema Privileges assigned to the User

Schemata

- bikedb
- colorsurvey
- guestbook
- information_schema
- mailinglist
- mysql
- prog3
- sample
- test

Assigned Privileges

- SELECT
- INSERT
- UPDATE
- DELETE

Available Privileges

- CREATE Grants the CREATE privilege to the user
- DROP Grants the DROP privilege to the user
- GRANT Grants the GRANT privilege to the user
- REFERENCES Grants the REFERENCES privilege to the user
- INDEX Grants the INDEX privilege to the user
- ALTER Grants the ALTER privilege to the user
- CREATE_TMP_T... Grants the CREATE_TMP_TABLE privilege t...
- LOCK_TABLES Grants the LOCK_TABLES privilege to the user
- CREATE_VIEW Grants the CREATE_VIEW privilege to the user
- SHOW_VIEW Grants the SHOW_VIEW privilege to the user
- CREATE_ROUTINE... Grants the CREATE_ROUTINE privilege to th...
- ALTER_ROUTINE Grants the ALTER_ROUTINE privilege to the ...
- EXECUTE Grants the EXECUTE privilege to the user

Add new user Apply changes Discard changes

Select a user and a database to grant or revoke privileges.



MySQL Administrator - Connection: root@localhost:3306

File Edit View Tools Window MySQL Enterprise Help

Server Information
Service Control
Startup Variables
User Administration
Server Connections
Health
Server Logs
Replication Status
Backup
Restore
Catalogs

Schemata

bikedb
colorsurvey
guestbook
information_schema
mailinglist
mysql
prog3
sample
test

Schema Tables Schema Indices Views Stored procedures

bikedb
All tables of the bikedb schema

Table Name	Engine	Rows	Data length	Index length	Update time
bikes	InnoDB	12	16 kB	0 B	
bluebikes	InnoDB	2	16 kB	0 B	
celestebikes	InnoDB	2	16 kB	0 B	

Num. of Tables: 3 Rows: 16 Data Len: 48 kB Index Len: 0 B

Details >> Create Table Edit Table Maintenance Refresh

View of system catalogs which describe the databases maintained by the server.

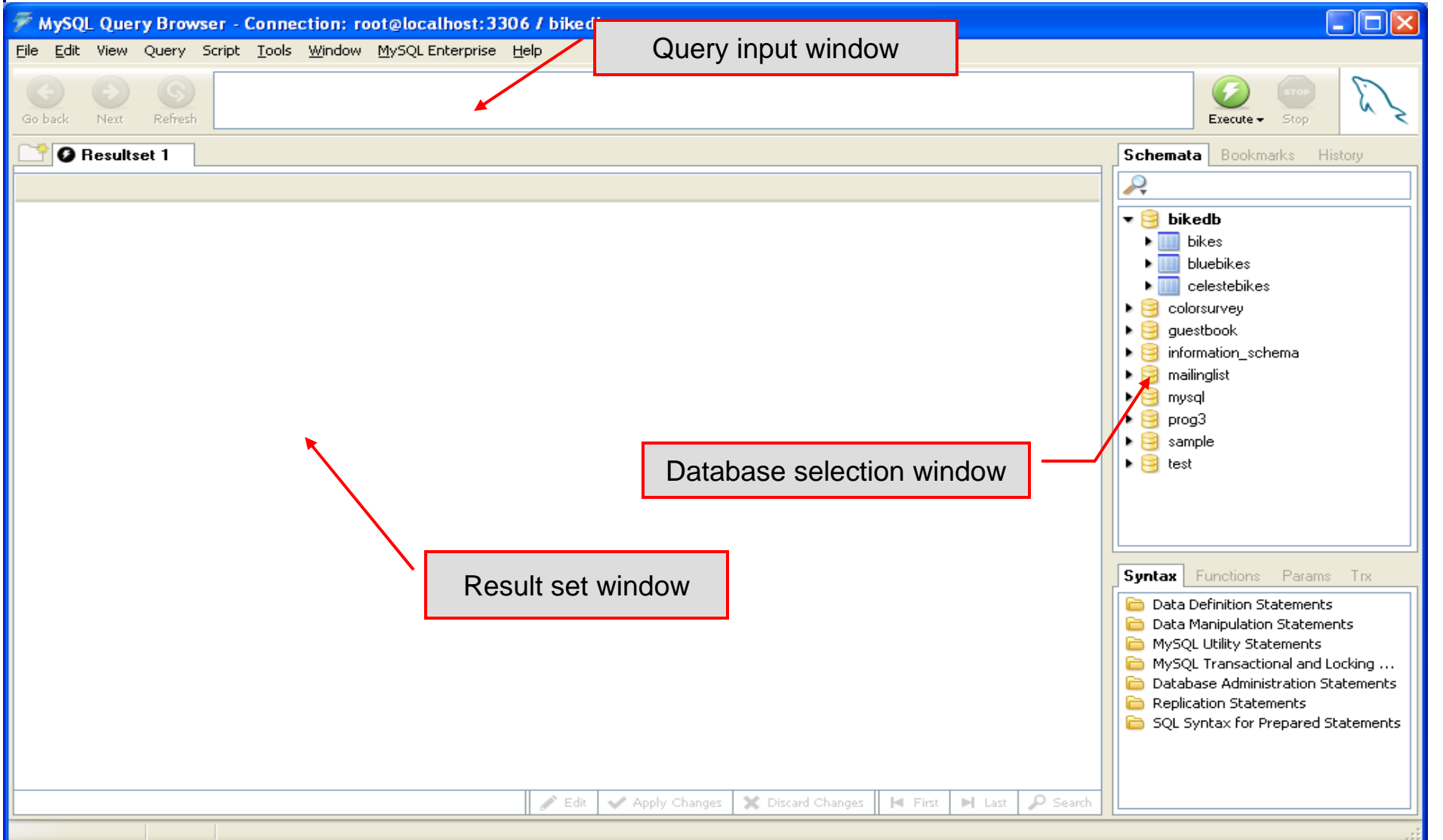


The MySQL Query Browser Tool

- From MySQL you can also download a GUI-based query browser tool.
- This tool implements all of the basic DML side of SQL with some limitation. For example, editing result sets is possible only if the result set was generated from a single table. Join-based result sets are not editable. This tool also implements many DDL commands.
- This tool is helpful for developing and testing queries.
- A few screen shots of this tool and its capabilities are shown in the next few slides.



A First Look At The MySQL Query Browser



A First Look At The MySQL Query Browser

The screenshot shows the MySQL Query Browser window. The title bar indicates the connection is 'root@localhost:3306 / bike...'. The menu bar includes File, Edit, View, Query, Script, Tools, Window, MySQL Enterprise, and Help. The toolbar has buttons for Go back, Next, Refresh, Execute, and Stop. The Query input window contains the text 'select * from bikes'. The Resultset window displays a table with 12 rows and 8 columns. The Schemata window on the right shows a tree view of databases, with 'bikedb' expanded to show 'bikes', 'bluebikes', and 'celestebikes'. The Syntax window at the bottom right lists various SQL statement types. Red arrows point from text boxes to specific parts of the interface: 'Query input window' points to the query text area, 'Database selection window' points to the 'bikes' database in the Schemata tree, 'Result set window' points to the table of results, and another box points to the table itself with a descriptive note.

MySQL Query Browser - Connection: root@localhost:3306 / bike...

File Edit View Query Script Tools Window MySQL Enterprise Help

Go back Next Refresh

Query input window

select * from bikes

Execute Stop

Resultset 1

bikename	lastoverhaul	size	color	cost	purchased	mileage	rides_ridden
Battaglin Carrera	NULL	60	red/white	4000	2001-03-14	11200	NULL
Bianchi Corse Evo 4	NULL	58	celeste	5700	2004-12-22	300	NULL
Bianchi Evolution 3	NULL	58	celeste	4800	2003-11-16	2000	NULL
Bianchi/Liquigas FG	NULL	58	celeste/blue	5600	2005-12-02	0	NULL
Colnago Dream Rabobank	NULL	60	blue/orange	5500	2002-07-27	4300	NULL
Colnago Superissimo	NULL	59	red	3800	1996-03-01	13000	NULL
Eddy Merckx Domo	NULL	58	blue/black	5300	2005-02-02	0	NULL
Eddy Merckx Molteni	NULL	58	orange	5100	2004-08-12	0	NULL
Eddy Merckx MXM	NULL	58	black/red	8200	2006-01-14	150	NULL
Gianni Motta Personal	NULL	59	red/green	4400	2000-05-01	8700	NULL
Gios Torino Super	NULL	60	blue	2000			
Schwinn Paramount P14	NULL	60	blue	1800			

Database selection window

Result set window

Result set shown for this query. Note that this query is based on a single table, so the result set is editable.

Schemata Bookmarks History

- bikedb
 - bikes
 - bluebikes
 - celestebikes
- coloursurvey
- guestbook
- information_schema
- mailinglist
- mysql
- prog3
- sample
- test

Syntax Functions Params Trx

Definition Statements
Manipulation Statements
Utility Statements
Transactional and Locking ...
Database Administration Statements
Transaction Statements
Syntax for Prepared Statements

12 rows fetched in 0.0067s (0.0870s)

Edit Apply Changes Discard Changes First Last Search



MySQL Query Browser - root@localhost:3306 / bikedb

File Edit View Query Script Tools Window Help

Go back Next Refresh

`SELECT * from bikes where cost > 4500`

Execute Stop

Resultset 1 Resultset 2 **Resultset 3 x**

bikename	size	color	cost	purchased	mileage
Bianchi Corse Evo 4	58	celeste	5700	2004-12-22	300
Bianchi Evolution 3	58	celeste	4800	2003-11-16	2000
Bianchi/Liquigas FG	58	celeste/blue	5600	2005-12-02	0
Colnago Dream Rabobank	60	blue/orange	5500	2002-07-27	4300
Eddy Merckx Domo	58	blue/black	5300	2005-02-02	0
Eddy Merckx Molteni	58	orange	5100	2004-08-12	0

Schemata Bookmarks History

bikedb

- bikes
- bluebikes
- information_schema
- mysql
- sample
- test

Syntax Functions Params Trx

- Data Manipulation
- Data Definition
- MySQL Utility
- Transactional and Locking

6 rows fetched in 0.0047s (0.0004s)

Edit Apply Changes Discard Changes First Last Search

1: 1

You can manage multiple result sets simultaneously. Statistics on query execution are always available.

