Introduction to MySQL

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Road Map

- Introduction to MySQL
- Connecting and Disconnecting
- Entering Basic Queries
- Creating and Using a Database

MySQL

- MySQL is a very popular, open source database.
- Officially pronounced “my Ess Que Ell” (not my sequel).
- Handles very large databases; very fast performance.
- Why are we using MySQL?
  - Free (much cheaper than Oracle!)
  - Each student can install MySQL locally.
  - Easy to use Shell for creating tables, querying tables, etc.
  - Easy to use with Java JDBC

Crash Course Fundamentals

- In order to use JDBC, you need:
  - a database.
  - basic understand of SQL (Structured Query Language)
- Some students may have database backgrounds; others may not.
- The purpose of this lecture is to get all students up to speed on database fundamentals.

Connecting to MySQL

- MySQL provides an interactive shell for creating tables, inserting data, etc.
- On Windows, just go to c:\mysql\bin, and type:
  - **`mysql`**
  - Or, click on the Windows icon
- On Linux Shell type:
  - **`mysql`**
  - Or, **`mysql`** –p (if password is given during installation)

Sample Session

- For example:

```
Enter password:  *****
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 241 to server version: 5.6.49

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

mysql>
```

- To exit the MySQL Shell, just type QUIT or EXIT:

```
mysql> QUIT
mysql> exit
```

Basic Queries

- Once logged in, you can try some simple queries.
- For example:

```
mysql> SELECT VERSION(), CURRENT_DATE;
+-----------+--------------+
| VERSION() | CURRENT_DATE |
+-----------+--------------+
| 3.23.49   | 2002-05-26   |
+-----------+--------------+
1 row in set (0.00 sec)
```

- Note that most MySQL commands end with a semicolon (;)
- MySQL returns the total number of rows found, and the total time to execute the query.

Basic Queries

- Keywords may be entered in any lettercase.
- The following queries are equivalent:

```
mysql> SELECT VERSION(), CURRENT_DATE;
mysql> select version(), current_date;
mysql> SeLeCt vErSiOn(), current_DATE;
```

Basic Queries

- Here's another query. It demonstrates that you can use mysql as a simple calculator:

```
mysql> SELECT SIN(PI()/4), (4+1)*5;
+---------------+----------+
| SIN(PI()/4) | (4+1)*5 |
+---------------+----------+
|     0.707107 |       25 |
+---------------+----------+
```

Basic Queries

- You can also enter multiple statements on a single line. Just end each one with a semicolon:

```
mysql> SELECT VERSION(); SELECT NOW();
+---------------+
| VERSION()     |
+---------------+
| 3.22.20a-log |
+---------------+
+---------------------+
| NOW()               |
+---------------------+
| 2004 00:15:33 |
+---------------------+
```

Multi-Line Commands

- mysql determines where your statement ends by looking for the terminating semicolon, not by looking for the end of the input line.
- Here's a simple multiple-line statement:

```
mysql> SELECT
    -> USER()
    -> ,
    -> CURRENT_DATE;
+---------------------+--------------+
| USER()              | CURRENT_DATE |
+---------------------+--------------+
| joesmith@localhost | 1999-03-18   |
+---------------------+--------------+
```

Canceling a Command

- If you decide you don't want to execute a command that you are in the process of entering, cancel it by typing \c

```
mysql> SELECT
    -> USER()
    -> \c
mysql>
```

Using a Database

- To get started on your own database, first check which databases currently exist.
- Use the SHOW statement to find out which databases currently exist on the server:

```
mysql> show databases;
+-----------+
| Database |
+-----------+
| mysql     |
| test      |
+-----------+
2 rows in set (0.01 sec)
```

Using a Database

- To create a new database, issue the "create database" command:
  - `mysql> create database webdb;`
- To the select a database, issue the "use" command:
  - `mysql> use webdb;`

Creating a Table

- Once you have selected a database, you can view all database tables:

```
mysql> show tables;
Empty set (0.02 sec)
```

- An empty set indicates that I have not created any tables yet.

Creating a Table

- Let's create a table for storing pets.
- Table: pet
  - name: VARCHAR(20)
  - owner: VARCHAR(20)
  - species: VARCHAR(20)
  - sex: CHAR(1)
  - birth: DATE
  - date: DATE

VARCHAR is usually used to store string data.

Creating a Table

- To create a table, use the CREATE TABLE command:

```
mysql> CREATE TABLE pet (
    -> name VARCHAR(20),
    -> owner VARCHAR(20),
    -> species VARCHAR(20),
    -> sex CHAR(1),
    -> birth DATE, death DATE);
Query OK, 0 rows affected (0.04 sec)
```

Showing Tables

- To verify that the table has been created:

```
mysql> show tables;
+-------------------+
| Tables_in_test    |
+-------------------+
| pet               |
+-------------------+
1 row in set (0.01 sec)
```

Describing Tables

- To view a table structure, use the DESCRIBE command:

```
mysql> describe pet;
+---------+-------------+------+-----+---------+-------+
| Field   | Type        | Null | Key | Default | Extra |
+---------+-------------+------+-----+---------+-------+
| name    | varchar(20) | YES  |     | NULL    |       |
| owner   | varchar(20) | YES  |     | NULL    |       |
| species | varchar(20) | YES  |     | NULL    |       |
| sex     | char(1)     | YES  |     | NULL    |       |
| birth   | date        | YES  |     | NULL    |       |
| death   | date        | YES  |     | NULL    |       |
+---------+-------------+------+-----+---------+-------+
6 rows in set (0.02 sec)
```

Deleting a Table

- To delete an entire table, use the DROP TABLE command:

```
mysql> drop table pet;
Query OK, 0 rows affected (0.02 sec)
```

Loading Data

- Use the INSERT statement to enter data into a table.
- For example:

```
INSERT INTO pet VALUES
  ('Fluffy','Harold','cat','f',
  '1999-02-04',NULL);
```

- The next slide shows a full set of sample data.

More data…

name	owner	species	sex	birth	death
Fluffy	Harold	cat	f	1993-02-04	
Claws	Gwen	cat	m	1994-03-17	
Buffy	Harold	dog	f	1989-05-13	
Fang	Benny	dog	m	1990-08-27	
Bowser	Diane	dog	m	1998-08-31	1995-07-29
Chirpy	Gwen	bird	f	1998-09-11	
Whistler	Gwen	bird		1997-12-09	
Slim	Benny	snake	m	1996-04-29	

Loading Sample Data

- You could create a text file `pet.txt' containing one record per line.
- Values must be separated by tabs, and given in the order in which the columns were listed in the CREATE TABLE statement.
- Then load the data via the LOAD DATA Command.

Sample Data File

Fluffy	Harold	cat	f	1993-02-04	\N
Claws	Gwen	cat	m	1994-03-17	\N
Buffy	Harold	dog	f	1989-05-13	\N
Fang	Benny	dog	m	1990-08-27	\N
Bowser	Diane	dog	m	1979-08-31	1995-07-29
Chirpy	Gwen	bird	f	1998-09-11	\N
Whistler	Gwen	bird	\N	1997-12-09	\N
Slim	Benny	snake	m	1996-04-29	\N

To Load pet.txt:

```
mysql>  LOAD DATA LOCAL INFILE "pet.txt" INTO TABLE pet;
```

For each of the examples, assume the following set of data.

name	owner	species	sex	birth	death
Fluffy	Harold	cat	f	1993-02-04	
Claws	Gwen	cat	m	1994-03-17	
Buffy	Harold	dog	f	1989-05-13	
Fang	Benny	dog	m	1990-08-27	
Bowser	Diane	dog	m	1998-08-31	1995-07-29
Chirpy	Gwen	bird	f	1998-09-11	
Whistler	Gwen	bird		1997-12-09	
Slim	Benny	snake	m	1996-04-29	

SQL Select

- The SELECT statement is used to pull information from a table.
- The general format is:

```
SELECT what_to_select
FROM which_table
WHERE conditions_to_satisfy
```

Selecting All Data

- The simplest form of SELECT retrieves everything from a table

```
mysql> select * from pet;
+----------+--------+---------+------+------------+------------+
| name     | owner  | species | sex  | birth      | death      |
+----------+--------+---------+------+------------+------------+
| Fluffy   | Harold | cat     | f    | 1999-02-04 | NULL       |
| Claws    | Gwen   | cat     | f    | 1994-03-17 | NULL       |
| Buffy    | Harold | dog     | f    | 1989-05-13 | NULL       |
| Fang     | Benny  | dog     | m    | 1999-08-27 | NULL       |
| Bowser   | Diane  | dog     | m    | 1998-08-31 | 1995-07-29 |
| Chirpy   | Gwen   | bird    | f    | 1998-09-11 | NULL       |
| Whistler | Gwen   | bird    |      | 1997-12-09 | NULL       |
| Slim     | Benny  | snake   | m    | 1996-04-29 | NULL       |
+----------+--------+---------+------+------------+------------+
8 rows in set (0.00 sec)
```

Selecting Particular Rows

- You can select only particular rows from your table.
- For example, if you want to verify the change that you made to Bowser's birth date, select Bowser's record like this:

```
mysql> SELECT * FROM pet WHERE name = "Bowser";
+--------+-------+---------+------+------------+------------+
| name   | owner | species | sex  | birth      | death      |
+--------+-------+---------+------+------------+------------+
| Bowser | Diane | dog     | m    | 1998-08-31 | 1995-07-29 |
+--------+-------+---------+------+------------+------------+
1 row in set (0.00 sec)
```

Selecting Particular Rows

- To find all animals born after 1998

```
SELECT * FROM pet WHERE birth >= "1998-1-1";
```

- To find all female dogs, use a logical AND

```
SELECT * FROM pet WHERE species = "dog" AND sex = "f";
```

- To find all snakes or birds, use a logical OR

```
SELECT * FROM pet WHERE species = "snake"
OR species = "bird";
```

Selecting Particular Columns

- If you don't want to see entire rows from your table, just name the columns in which you are interested, separated by commas.
- For example, if you want to know when your pets were born, select the name and birth columns.
- (see example next slide.)

Selecting Particular Columns

```
mysql> select name, birth from pet;
+----------+------------+
| name     | birth      |
+----------+------------+
| Fluffy   | 1999-02-04 |
| Claws    | 1994-03-17 |
| Buffy    | 1989-05-13 |
| Fang     | 1999-08-27 |
| Bowser   | 1998-08-31 |
| Chirpy   | 1998-09-11 |
| Whistler | 1997-12-09 |
| Slim     | 1996-04-29 |
+----------+------------+
8 rows in set (0.01 sec)
```

Sorting Data

- To sort a result, use an ORDER BY clause.
- For example, to view animal birthdays, sorted by date:

```
mysql> SELECT name, birth FROM pet ORDER BY birth;
+----------+------------+
| name     | birth      |
+----------+------------+
| Buffy    | 1989-05-13 |
| Claws    | 1994-03-17 |
| Slim     | 1996-04-29 |
| Whistler | 1997-12-09 |
| Bowser   | 1998-08-31 |
| Chirpy   | 1998-09-11 |
| Fluffy   | 1999-02-04 |
| Fang     | 1999-08-27 |
+----------+------------+
8 rows in set (0.02 sec)
```

Sorting Data

- To sort in reverse order, add the DESC (descending keyword)

```
mysql> SELECT name, birth FROM pet ORDER BY birth DESC;
+----------+------------+
| name     | birth      |
+----------+------------+
| Fang     | 1999-08-27 |
| Fluffy   | 1999-02-04 |
| Chirpy   | 1998-09-11 |
| Bowser   | 1998-08-31 |
| Whistler | 1997-12-09 |
| Slim     | 1996-04-29 |
| Claws    | 1994-03-17 |
| Buffy    | 1989-05-13 |
+----------+------------+
8 rows in set (0.02 sec)
```

Working with NULLs

- NULL means missing value or unknown value.
- To test for NULL, you cannot use the arithmetic comparison operators, such as =, < or <>.
- Rather, you must use the IS NULL and IS NOT NULL operators instead.

Working with NULLs

- For example, to find all your dead pets (what a morbid example!)

```
mysql> select name from pet where death
  >IS NOT NULL;
+--------+
| name   |
+--------+
| Bowser |
+--------+
1 row in set (0.01 sec)
```

Pattern Matching

- MySQL provides:
  - standard SQL pattern matching; and
  - regular expression pattern matching, similar to those used by Unix utilities such as vi, grep and sed.
- SQL Pattern matching:
  - To perform pattern matching, use the LIKE or NOT LIKE comparison operators
  - By default, patterns are case insensitive.
- Special Characters:
  - _ Used to match any single character.
  - % Used to match an arbitrary number of characters.

Pattern Matching Example

- To find names beginning with ‘b’:

```
mysql> SELECT * FROM pet WHERE name LIKE "b%";
+--------+--------+---------+------+------------+------------+
| name   | owner  | species | sex  | birth      | death      |
+--------+--------+---------+------+------------+------------+
| Buffy  | Harold | dog     | f    | 1989-05-13 | NULL       |
| Bowser | Diane  | dog     | m    | 1989-08-31 | 1995-07-29 |
+--------+--------+---------+------+------------+------------+
```

Pattern Matching Example

- To find names ending with `fy':

```
mysql> SELECT * FROM pet WHERE name LIKE "%fy";
+--------+--------+---------+------+------------+-------+
| name   | owner  | species | sex  | birth      | death |
+--------+--------+---------+------+------------+-------+
| Fluffy | Harold | cat     | f    | 1993-02-04 | NULL  |
| Buffy  | Harold | dog     | f    | 1989-05-13 | NULL  |
+--------+--------+---------+------+------------+-------+
```

Pattern Matching Example

- To find names containing a ‘w’:

```
mysql> SELECT * FROM pet WHERE name LIKE "%w%";
+----------+-------+---------+------+------------+------------+
| name     | owner | species | sex  | birth      | death      |
+----------+-------+---------+------+------------+------------+
| Claws    | Gwen  | cat     | m    | 1994-03-17 | NULL       |
| Bowser   | Diane | dog     | m    | 1989-08-31 | 1995-07-29 |
| Whistler | Gwen  | bird    | NULL | 1997-12-09 | NULL       |
+----------+-------+---------+------+------------+------------+
```

Pattern Matching Example

- To find names containing exactly five characters, use the _ pattern character:

```
mysql> SELECT * FROM pet WHERE name LIKE "_____";
+-------+--------+---------+------+------------+-------+
| name  | owner  | species | sex  | birth      | death |
+-------+--------+---------+------+------------+-------+
| Claws | Gwen   | cat     | m    | 1994-03-17 | NULL  |
| Buffy | Harold | dog     | f    | 1989-05-13 | NULL  |
+-------+--------+---------+------+------------+-------+
```

Regular Expression Matching

- The other type of pattern matching provided by MySQL uses extended regular expressions.
- When you test for a match for this type of pattern, use the REGEXP and NOT REGEXP operators (or RLIKE and NOT RLIKE, which are synonyms).

Regular Expressions

- Some characteristics of extended regular expressions are:
  - . matches any single character.
  - A character class [...] matches any character within the brackets. For example, [abc] matches a, b, or c. To name a range of characters, use a dash. [a-z] matches any lowercase letter, whereas [0-9] matches any digit.
  - * matches zero or more instances of the thing preceding it. For example, x* matches any number of x characters, [0-9]* matches any number of digits, and .* matches any number of anything.
  - To anchor a pattern so that it must match the beginning or end of the value being tested, use ^ at the beginning or $ at the end of the pattern.

Reg Ex Example

- To find names beginning with b, use ^ to match the beginning of the name:

```
mysql> SELECT * FROM pet WHERE name REGEXP "^b";
+--------+--------+---------+------+------------+------------+
| name   | owner  | species | sex  | birth      | death      |
+--------+--------+---------+------+------------+------------+
| Buffy  | Harold | dog     | f    | 1989-05-13 | NULL       |
| Bowser | Diane  | dog     | m    | 1989-08-31 | 1995-07-29 |
+--------+--------+---------+------+------------+------------+
```

Reg Ex Example

- To find names ending with `fy', use `$' to match the end of the name:

```
mysql> SELECT * FROM pet WHERE name REGEXP "fy$";
+--------+--------+---------+------+------------+-------+
| name   | owner  | species | sex  | birth      | death |
+--------+--------+---------+------+------------+-------+
| Fluffy | Harold | cat     | f    | 1993-02-04 | NULL  |
| Buffy  | Harold | dog     | f    | 1989-05-13 | NULL  |
+--------+--------+---------+------+------------+-------+
```

Counting Rows

- Databases are often used to answer the question, "How often does a certain type of data occur in a table?"
- For example, you might want to know how many pets you have, or how many pets each owner has.
- Counting the total number of animals you have is the same question as “How many rows are in the pet table?” because there is one record per pet.
- The COUNT() function counts the number of non-NULL results.

Counting Rows Example

- A query to determine total number of pets:

```
mysql> SELECT COUNT(*) FROM pet;
+----------+
| COUNT(*) |
+----------+
|        9 |
+----------+
```

Is that all there is to MySQL?

- Of course not!
- Understanding databases and MySQL could take us several weeks (perhaps months!)
- For now, focus on:
  - using the MySQL shell
  - creating tables
  - creating basic SQL queries

Summary

- SQL provides a structured language for querying/updating multiple databases.
- The more you know SQL, the better.
- The most important part of SQL is learning to retrieve data.
  - selecting rows, columns, boolean operators, pattern matching, etc.
- Keep playing around in the MySQL Shell.