

MySQL Databases

An introduction for the novice

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What is a Database?

- Store information(data) in a reliable, accessible way
- Allow access to data over a network to multiple users
- Provide easy way to select a specific “view” of the data

Relational Database

- A relational database is a collection of tables that can be dynamically (and temporarily) combined into a single table. Columns of the contributing tables can be related to one another.
- In a non-relational database, the tables are always separate entities

A Few Terms:

- **Server** - Program that accepts connections and implements the database
- **Database** - A collection of tables on a single server. More than one “database” can exist on a single server
- **Table** - A set of column definitions

A Few Terms:

- **Column** - Provides a name and data type
- **Row** - A single entry in a table. It contains one value for every column (possibly NULL)
- **Query** - A command in SQL syntax for the database. It can insert, modify, or extract data.

M
y
S *tructured*
Q *uery*
L *anguage*

ANSI/ISO
Standard:

1992

1999

2003

SQL: Structured Query Language

- SQL is a syntax for probing and manipulating a database.

Creating a table

```
CREATE TABLE IF NOT EXISTS friends(  
    id                int PRIMARY KEY AUTO_INCREMENT,  
    firstname         char(255) NOT NULL,  
    lastname          char(255),  
    pets_name         char(255),  
    age               int,  
    status            ENUM("like","hate") default 'like',  
    created            datetime,  
    modified          timestamp  
) TYPE=MyISAM;
```

The INSERT statement

```
INSERT INTO friends
```

```
(firstname,lastname,pets_name,age,created)
```

```
VALUES("Amelia", "Lawrence", "Star", 8, NOW());
```

The SELECT statement

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TIFF (LZW) decompressor
are needed to see this picture.

The SELECT statement

SELECT can specify both columns and rows...

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The SELECT statement

SELECT can limit the number of rows returned...

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The SELECT statement

SELECT can also be used with functions...

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The SELECT statement

SELECT can do math ...

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UPDATEing table data

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The DELETE statement

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Database Table Design is an Art!

```
# ---- BAD -----
```

```
CREATE TABLE IF NOT EXISTS tagger_e_cal_days (
  id int,
  tagger_e_cal_days int,
);
```

"If you have to do more than one query to get the data you want out of the database, you have not done a good job designing your tables."

```
CREATE TABLE IF NOT EXISTS tagger_table_names (
  run int,
  tagger_table_names char(255)
);
```

-R. Chapman, Professional Database Designer

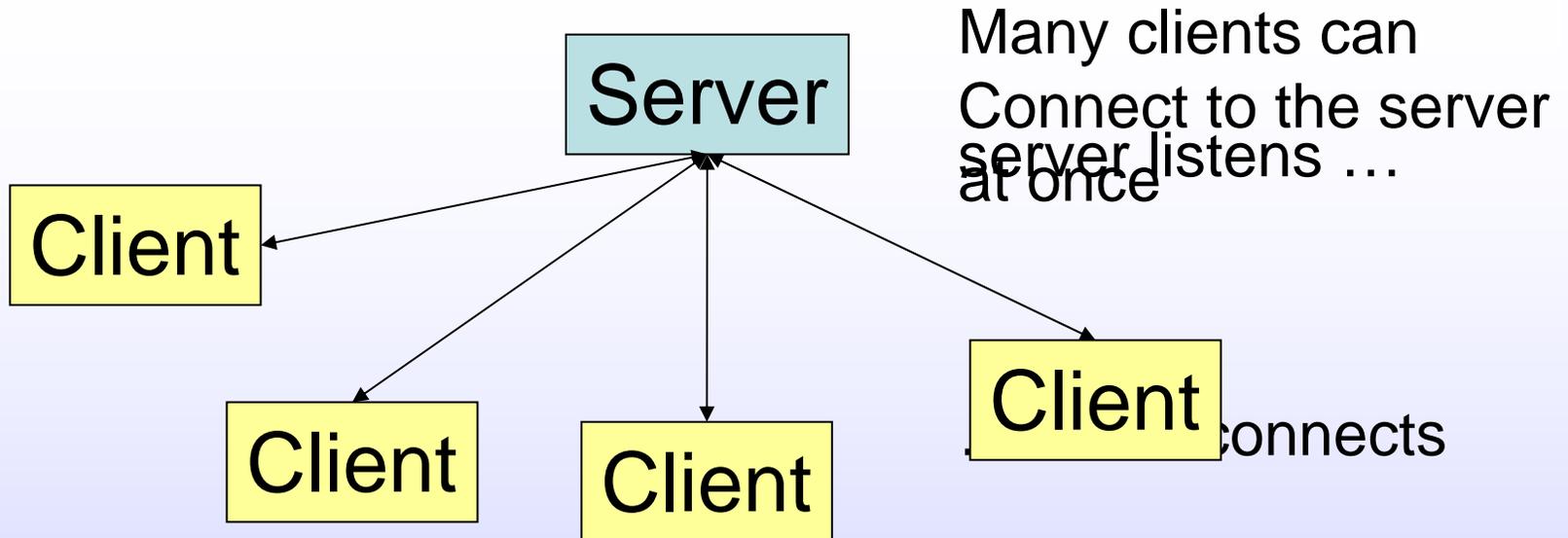
```
tagger_e_cal_table char(255)
```

```
);
```

Database Table Design is an Art!

```
# ---- GOOD -----  
CREATE TABLE IF NOT EXISTS tagger_t_cal(  
    run          int NOT NULL,  
    tid          int NOT NULL,  
    toffset_l   int,  
    toffset_r   int,  
    PRIMARY KEY(run,tid)  
);
```

Client/Server Model



Permissions/Access Control

- Permissions are kept by server independent of any Unix system
- Accounts are determined by the host you connect from and the username ***you supply***
- Permissions can be granted at the **global**, **database**, **table** and **column** levels
- Permissions can be granted for all or only a partial set of commands

Permissions/Access Control

- Use the GRANT and REVOKE commands to set permissions:

```
GRANT ALL PRIVILEGES ON test.* TO  
joebob@'%.jlab.org' IDENTIFIED BY "tutu"
```

```
REVOKE ALL PRIVILEGES ON test.* FROM  
joebob@'%.jlab.org' IDENTIFIED BY "tutu"
```

The *mysql* command-line tool

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API: Application Programming Interface

- The API provides the means to access the database from your language of choice
 - **C**
 - **Perl**
 - **PHP**
 - **Java (JDBC)**
 - **Python**
 - **Tcl**
 - **Eiffel**

C API

- Very useful for adding database access to C programs, but most jobs are better done in scripting languages
 - `mysql_init()`
 - `mysql_real_connect()`
 - `mysql_query()`
 - `mysql_store_result()`
 - `mysql_fetch_row()`
 - `mysql_free_result()`
 - `mysql_close()`

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Compiling the C program

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Perl API

- Uses the ***DBI*** and ***DBD-mysql*** modules
 - DBI->connect()
 - prepare()
 - execute()
 - fetchrow_arrayref()
 - fetchrow_hashref()
 - disconnect()

Perl API

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PHP API

- The PHP interface is extremely valuable for interfacing a MySQL database with a web page
 - `mysql_connect()`
 - `mysql_select_db()`
 - `mysql_query()`
 - `mysql_fetch_array()`
 - `mysql_close()`

PHP API

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Java API

- Java uses JDBC to interface to MySQL
 - `Class.forName()`
 - `getConnection()`
 - `createStatement()`
 - `executeQuery()`
 - `next()`
 - `getString()`
 - `getInt()`

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Backing Up: *mysqldump*

- The `mysqldump` command line utility can print the entire contents of a database to the screen.
 - `-d` option says ***don't*** include table data
 - `-t` option says ***don't*** include table definitions
 - Individual tables can be specified

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Supported Platforms

- AIX
- Amiga
- BSDI
- Digital Unix
- FreeBSD
- HP-UX
- Linux
- SunOS
- True64
- Mac OS X
- NetBSD
- Novell Netware
- OpenBSD
- OS/2 Warp
- SCO Unix
- SGI
- True64
- MS Windows

Summary

- MySQL is a popular, free database well suited to most applications
- There are APIs supporting many programming languages including PHP which makes a powerful combination for generating web pages

See more at <http://www.mysql.com>