CS320 Web and Internet Programming
SQL and MySQL

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Web and Databases

◆ E-commerce sites
- Products, order, customers

◆ News sites
- Subscribers, articles

◆ Web boards
- Users, postings

◆ ... anywhere where a large amount of information needs to be managed safely and efficiently

A Relational DB Example

employees

id	first_name	last_name	address	supervisor_id
1	Chengyu	Sun	Street #215	null
2	John	Doe	Street #711	1

projects

id	name	leader_id
1	Firestone	1
2	Blue	2

project_members

project_id	employee_id
1	1
2	1
2	2

Terminology
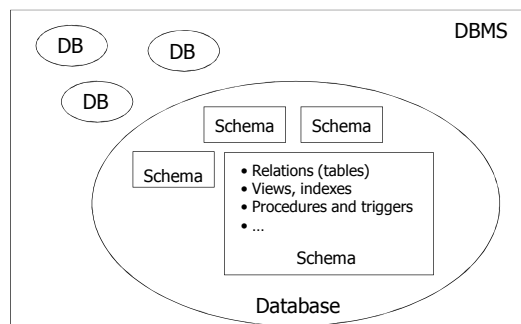
DBMS

◆ Database Management System (DBMS) is a software that manages databases

◆ Common DBMS
- Commercial – Oracle, IBM DB2, MS SQL Server, Access
- Open source – MySQL, PostgreSQL

Database and Schema

◆ A database is a collection of data managed by a DBMS

◆ A database contains one or more *schemas*

◆ A schema contains a number of *schema elements*, such as tables, indexes, stored procedures, and so on

More Terminology

Table (relation)   Attributes (fields, columns)

student_id	name
1001	John Doe
1002	Jane Doe

students

Rows (Records) (Tuples)

Table (relation) schema:
students(student_id, name)

Database schema: database name + table schemas

SQL

- Structured Query Language
- Standard query language of relational databases
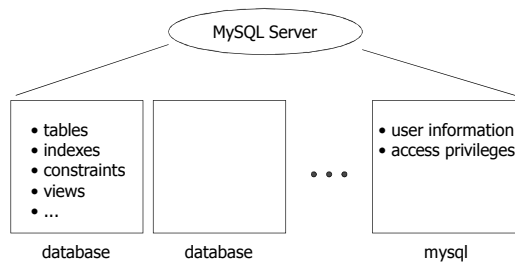- Supported by all major relational databases with some variations

SQL Script

- A text file contains SQL *statements* and *comments*
  - Statements: `select, insert, create` …
  - Comments
    - lines started with **--**
    - MySQL also supports C-style comment syntax, i.e. **/* */**
- Usually uses the .sql suffix

MySQL

- Very popular in web development
  - Open source
  - Very fast search
  - Full text indexing and search
  - Developer-friendly features
    - drop table if exists
    - insert … on duplicate key update
    - /* */
    - …

Databases in MySQL

MySQL Server

- tables
- indexes
- constraints
- views
- …

database

database

• • •

- user information
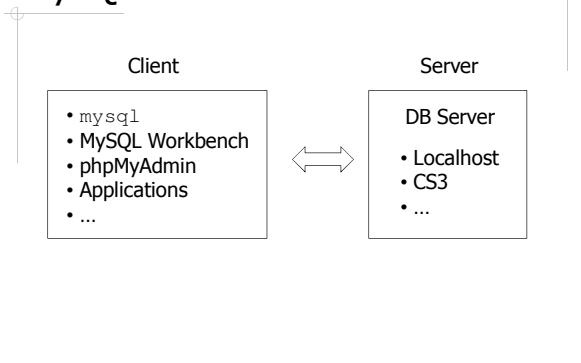- access privileges

mysql

In MySQL, schema = database

MySQL on the CS3 Server

- Version 5.5
- One database per account
  - DB name is the same as the server account username. E.g. `cs320stu31`
  - Username and password are the same as the ones for the server account

Client-Server Architecture of MySQL

Client
- mysql
- MySQL Workbench
- phpMyAdmin
- Applications
- ...

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Server

DB Server
- Localhost
- CS3
- ...

Connect to a MySQL Database

- Use one of the client software
- Create a connection with the information about the server
  - Host
  - Port (default 3306)
  - Username
  - Password
  - Default Database/Schema

Connect to Your MySQL Database on CS3

- http://csns.calstatela.edu/wiki/content/cysun/course_materials/cs3
  - Command line client mysql
  - MySQL Workbench
  - phpMyAdmin
- Change password
  - set password = password ('something');

Run SQL Scripts

- Command line client
  - \. *path/to/script.sql*
  - source *path/to/script.sql;*
- MySQL Workbench
  - *SQL Editor* → File → Open SQL Script → Execute
- phpMyAdmin
  - Import
    - Format of the imported file: SQL

Schema Design Example

- Employee and Project

```
public class Employee {        public class Project{
    Integer   id;                  Integer         id;
    String    firstName;           String          name;
    String    lastName;            Employee        leader;
    String    address;             Set<Employee>   members;
    Employee  supervisor;      }
}
```

Simple Schema Design Rules

OO	**Relational**
Class	Table
Class variables	Attributes
Java types	SQL types
Object References	IDs
Collection	New Table (possibly)

Create a Table

```
create table table_name (
    field_name field_type [NOT NULL] [UNIQUE] [DEFAULT value],
    field_name field_type [NOT NULL] [UNIQUE] [DEFAULT value],
    ...
    [PRIMARY KEY(field_name, ...)]
);

    create table employees (
        id              integer auto_increment primary key,
        first_name      varchar(255) not null,
        last_name       varchar(255) not null,
        address         varchar(255),
        supervisor_id   integer references employees(id)
    );
```

Naming Conventions

- Use plural form for table names
- Use singular form for column names
- Use underscore to concatenate multiple words, e.g. `employee_id`
  - Do not use mixed cases in names (e.g. `ArtistName`) because many DBMS treat names as case-insensitive

About CREATE TABLE

- Field types
  - integer, real, char(n), varchar(n)
  - date, time, datetime, timestamp
- auto_increment
- Integrity constraints
  - unique, not null, primary key
  - foreign key

Populate Tables

insert into table values (value1, value2, ...);

insert into table (field, ...) values (value, ...);

Search for Records

select field(s) from table(s) where condition(s);

- Find the name and address of employee with id=1
- Find the name of employee who leads the project Firestone
- Find the name of John Doe's supervisor
- Find the number of projects led by John Doe

Update Records

update table set field=value [, ...]
    where condition(s);

- Change John Doe's address to 123 Main St.
- Change John Doe's name to Tom Smith

Delete Records

delete from table where condition(s);

◆ Delete all the projects led by John Doe
◆ Delete all the projects

Delete Tables and Databases

◆ Delete a database
  ▪ drop database cs320stu31; -- don't do this!
◆ Delete a table
  ▪ drop table projects;
  ▪ drop table if exists projects; -- MySQL only

Readings

◆ CS122 Textbook
◆ MySQL Reference Manual
  ▪ String functions
  ▪ Date and time functions