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

Database vs. File

- More efficient search
- ACID
  - Atomicity
  - Consistency
  - Isolation
  - Durability

Relational Model

- Proposed by Edgar F. Codd in earlier 1970’s
- All major DBMS are relational (and the good ones are object-relational)

A Relational DB Example

<table>
<thead>
<tr>
<th>OID</th>
<th>CID</th>
<th>CID</th>
<th>ODATE</th>
<th>SDATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>001</td>
<td>001</td>
<td>4/25/2004</td>
<td>NULL</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CID</th>
<th>FNAME</th>
<th>LNAME</th>
<th>ADDRESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>Chengyu</td>
<td>Sun</td>
<td>Street #215</td>
</tr>
<tr>
<td>002</td>
<td>Steve</td>
<td>Sun</td>
<td>Street #711</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PID</th>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU01</td>
<td>Intel Pentium</td>
<td>$299</td>
</tr>
<tr>
<td>CPU02</td>
<td>Solar PII</td>
<td>$49</td>
</tr>
<tr>
<td>CPU03</td>
<td>Athlon XP</td>
<td>$100</td>
</tr>
<tr>
<td>MB001</td>
<td>ASUS</td>
<td>$128</td>
</tr>
<tr>
<td>MB002</td>
<td>TYAN</td>
<td>$400</td>
</tr>
</tbody>
</table>

Terminology

- Database Management System (DBMS)
- Database
- Table, relation
- Attribute, field
  - Type
- Record, tuple, row
- Column
- Schema
**SQL**
- Standard query language of relational databases
- Supported by all major relational databases with some variations

**MySQL**
- Not a good DBMS in the traditional sense
- Very popular in web development
  - Very fast search
  - Full text indexing and search
  - Many small things
    - drop if exists
    - insert into values
    - */ */
    - ...

**Databases in MySQL**
- MySQL Server
  - tables
  - indexes
  - constraints
  - views
  - ...
  - database
  - database
  - mysql
  - user information
  - access privileges

**MySQL on the CS Server**
- Version 4.0.21
- One database per user
  - DB name is the same as the server account user name. E.g. cs320stu31
- Connect to the database
  - `mysql -p`
  - Username and password are the same as the ones for the server account

**mysql Command Line Options**
- `mysql [database]`
- `-u username`
  - default: current user
- `-p`
  - required if the password for the account is not empty
- `-h hostname`
  - default: localhost
  - on CS server, you have to do:
    - `mysql -h localhost.localdomain`

**Some MySQL Commands ...**
- `Status`
  - `status`
- `Help`
  - `?` or `help`
- `Quite MySQL client`
  - `!q` or `quit`; or exit;
- `Change password`
  - `set password = password('something')`
  - `set password for 'user'@'host' = password('something')`
... Some MySQL Commands ...

- Show databases
  - show databases;
- Use database
  - use dbname;
- Show tables
  - show tables;
- Show table schema
  - describe tablename;

... Some MySQL Commands

- Run a script
  - \ demo.sql or source demo.sql;
- Run a script at command prompt
  - mysql < demo.sql

Create a Table

```sql
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, ...)]
);
```

```sql
CREATE TABLE products (  
  prod_id char(6) not null,  
  description text,  
  price decimal(12,2),  
  primary_key (prod_id)  
);
```

Field Types

- Numerical types
  - int, float, double, decimal(m,n)
- String types
  - char(n), varchar(n)
- Date and time
  - date, time, datatime, timestamp
    - 'yyyy-mm-dd hh:mm:ss'

Auto Increment Field

```sql
CREATE TABLE users (  
  id int auto_increment primary key,  
  username varchar(64) not null unique,  
  password char(16)
);
```

```sql
INSERT INTO users (username, password) VALUES ('cysun', 'abcd');
```

```sql
INSERT INTO users (username, password) VALUES ('csun', 'xyz');
```

Populate Tables

- Insert a record
  - insert into orders values (1000, 1, 2004-04-29, 2004-05-01);
  - insert into orders values (1001, 2, 2004-05-61, NULL);
- Load a data file
  - load data local infile 'orders.txt' into table orders;
- Import a data file (at command prompt)
  - mysqlimport -u cs20stu31 -p orders.txt
    - 'N' for NULL
**Search for Records**

- select field(s) from table(s) where condition(s);
  - select description, price from products;
  - select * from products;
  - select * from products where price < 300;
  - select * from products where prod_id = 'cpu-0001';

**Pattern Matching**

- LIKE, REGEXP
  - % -- any zero or more characters
  - _ -- any single character
  - [abc], [a-z], [0-9] -- range
  - * -- zero or more instances of the preceding character
  - ^ -- beginning of a string
  - $ -- end of a string
  - select * from products where description like '%intel%';

**Update Records**

- update table set field=value [, ... ] where condition(s);
  - update products set price=320 where prod_id = 'cpu-0001';
  - update products set price=200, description='Intel Pentium M 1.7GHz' where prod_id = 'cpu-0001';

**Delete Records**

- delete from table where condition(s);
  - Examples:
    - delete from orders;
    - delete from orders where order_date < '2003-12-31' and ship_date is not null;
  - Drop a database
    - drop database cs320stu34; -- Don't do this!
  - Drop a table
    - drop table products;