CS3220 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 forums
  - 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	John	Doe	Street #215	null
2	Jane	Doe	Street #711	1

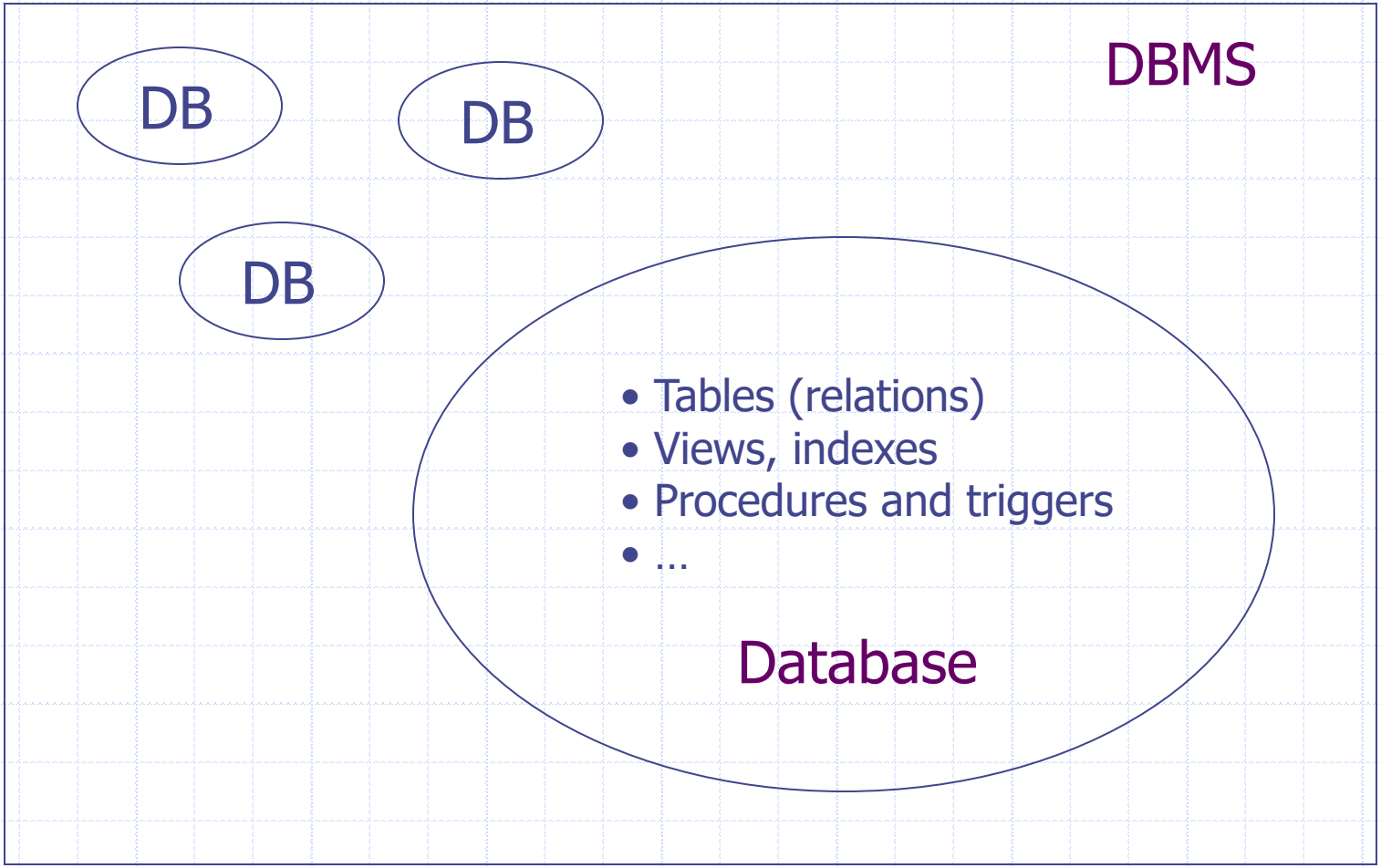
projects

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

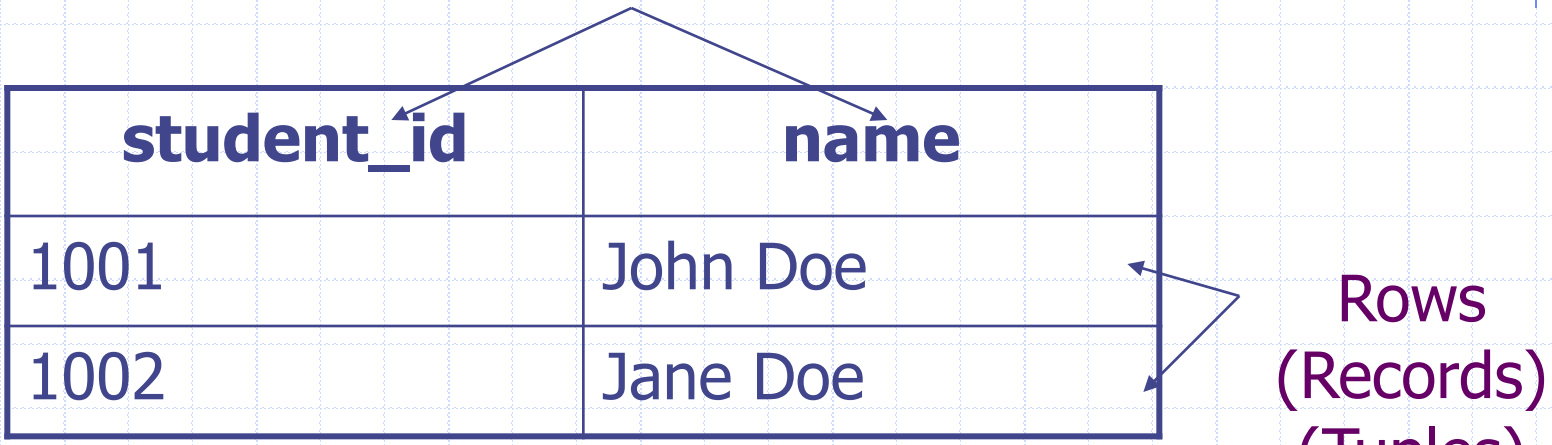
Database and Schema

- A database is a collection of data managed by a DBMS
- In MySQL, a database is also called a schema
- A database contains a number of *database objects* (a.k.a. *schema elements*) such as tables, indexes, stored procedures, and so on

More Terminology

Table (relation)

Attributes (fields, columns)



students

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

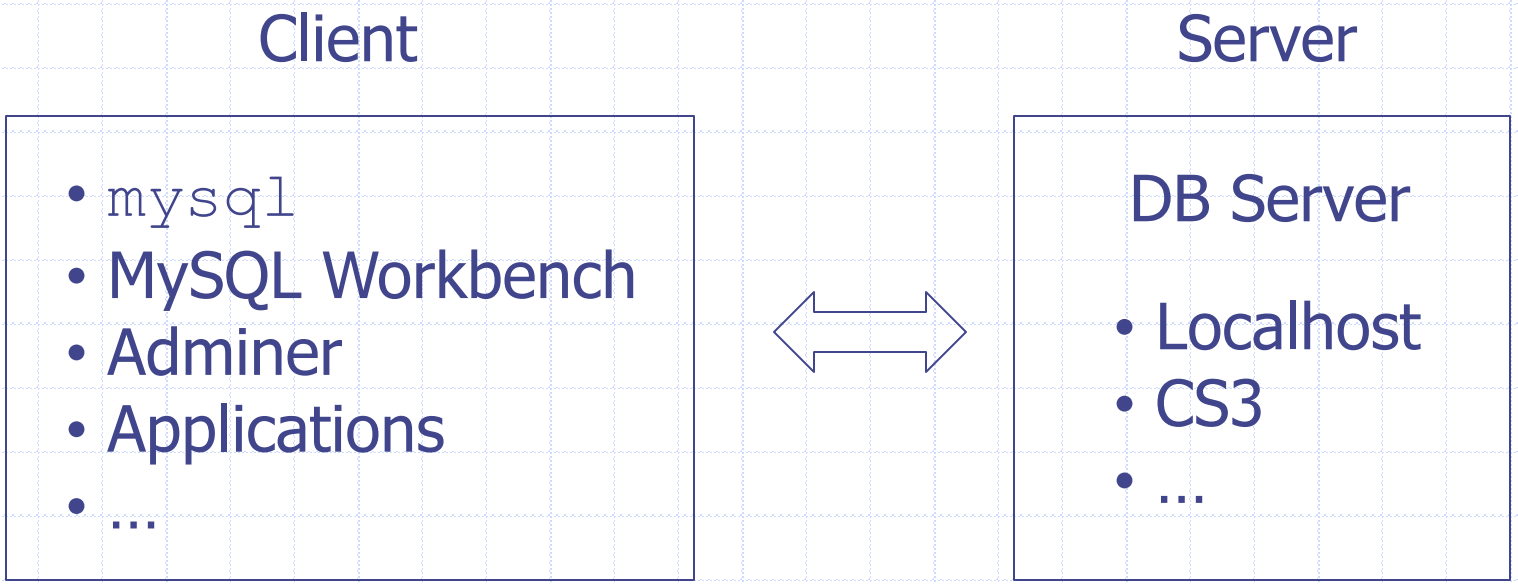
MySQL

- 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
    - /* */
    - ...

MySQL on the CS3 Server

- Version 8.0
- One database per account
  - DB name is the same as the server account username. E.g. `cs3220stu31`
  - Username and password are the same as the ones for the server account

Client-Server Architecture of MySQL



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
  - Database/Schema

Connect to Your MySQL Database on CS3

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

Run SQL Scripts

- Adminer
  - Import (File Upload)
- MySQL Workbench
  - *SQL Editor* → Open SQL Script → Execute
- Command line client
  - \. *path/to/script.sql*
  - source *path/to/script.sql;*

Schema Design Example

- Employee and Project

```
public class Employee {
    Integer     id;
    String      firstName;
    String      lastName;
    String      address;
    Employee    supervisor;
}
```

```
public class Project{
    Integer             id;
    String              name;
    Employee            leader;
    List<Employee>      members;
}
```

Simple Schema Design Rules ...

OO		Relational
Model Class		Table
Class fields	⇨	Attributes
Java types		SQL types

```
class Employee {
    Integer         id;
    String          firstName;
    String          lastName;
}
```

⇨

```
create table Employee (
    id      integer,
    firstName       varchar(255),
    lastName        varchar(255)
)
```

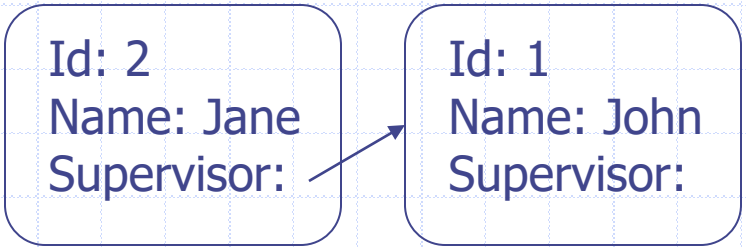
… Simple Schema Design Rules …

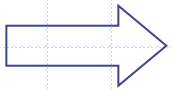
OO

Object References

Relational

IDs





Id	Name	SupervisorId
1	John	
2	Jane	1

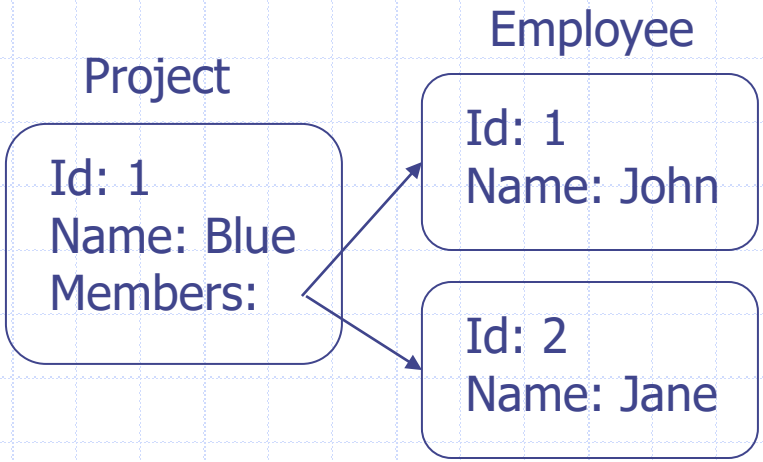
… Simple Schema Design Rules

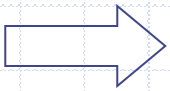
OO

Collection

Relational

New Table
with reference back to
the parent object





ProjectId	EmployeeId
1	1
1	2

Disclaimer: not all collections need to have their own tables

Create a Table

```
create table table_name (
    field_name field_type [constraint(s)],
    field_name field_type [constraint(s)],
    ...
);
```

```
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`, because some DBMS treat names as case-insensitive

About CREATE TABLE

- Field types
  - integer, float, double, 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 the employee with id=1
- Find the name of the employee who leads the project Firestone

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 the employee with id = 1
- Delete all the projects

Delete Tables

- drop table projects;
- drop table if exists projects;