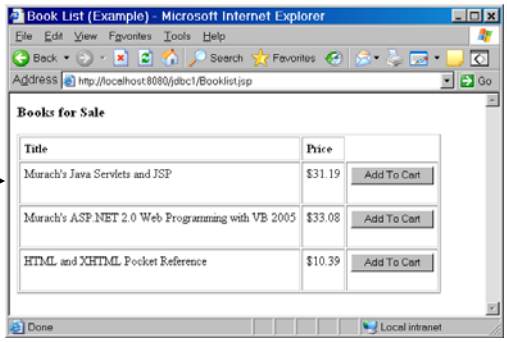
Server-side Web Programming

Lecture 12: **Server-side Databases and Drivers**

Databases and E-Commerce

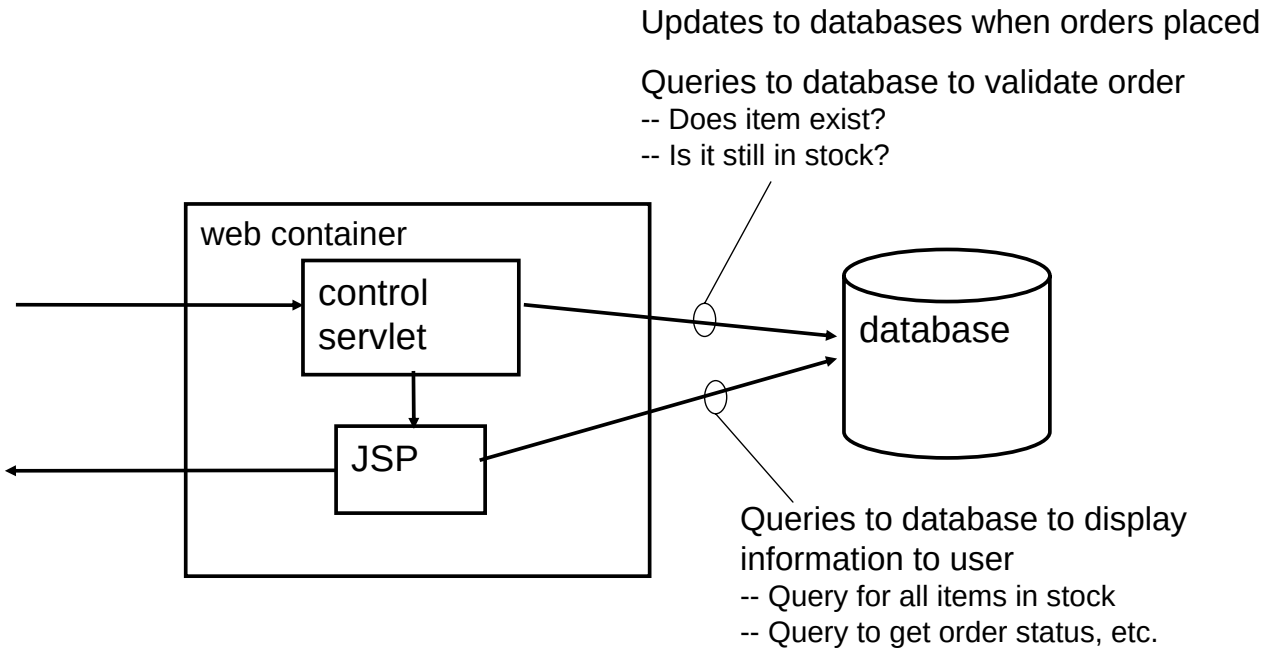
- Long term information stored in databases
  - Queries used to produce lists of products
    - Never hardwired in!

Generated by querying for all items in Books table →



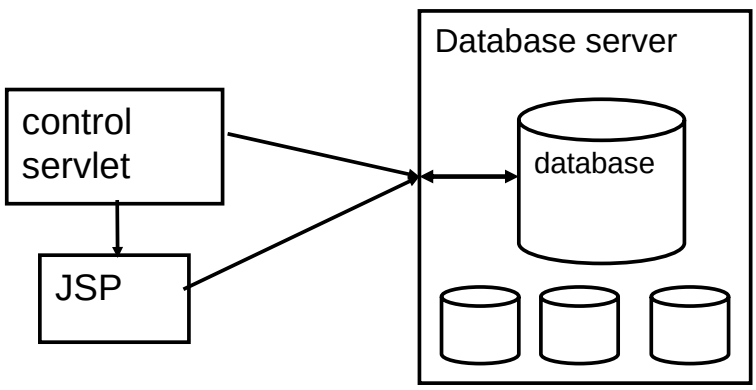
  - Updates used to store orders
    - New record created for order in Order table
    - Customer information added to other tables
    - Quantities updated in inventory tables

Databases and Web Programming



Database Servers

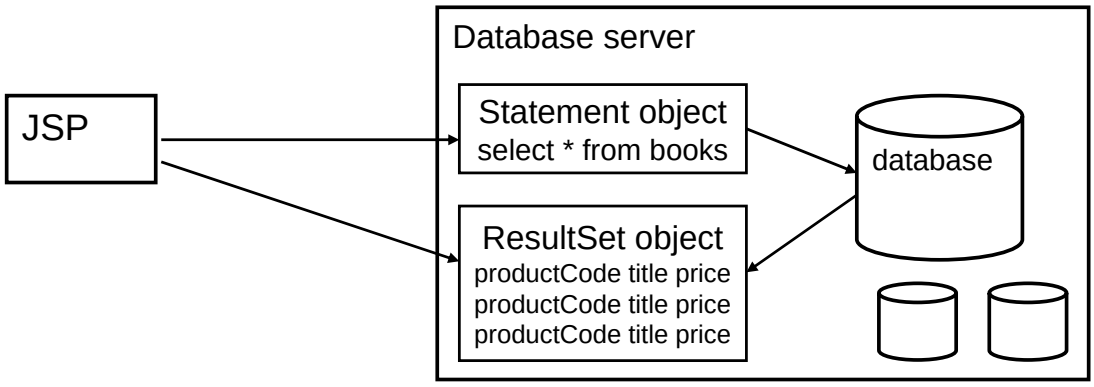
- Access to database controlled by database server
  - Constantly running (like web container)
  - Programs communicate with it
  - Server runs database queries and updates for databases it controls
  - Server handles security of database
    - Most are password-controlled
  - Examples:
    - MySQL (free)
    - Oracle
    - MS Server
    - Not Access!



Database Servers

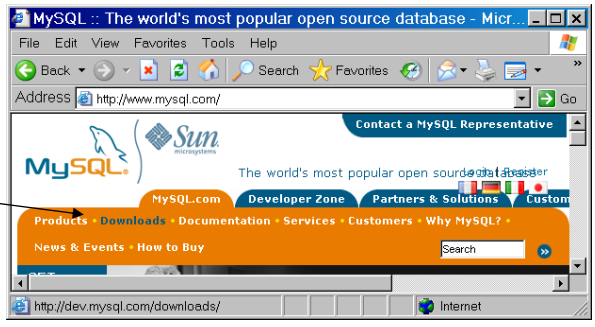
- Programs create statement objects inside server
- Server executes them on the database

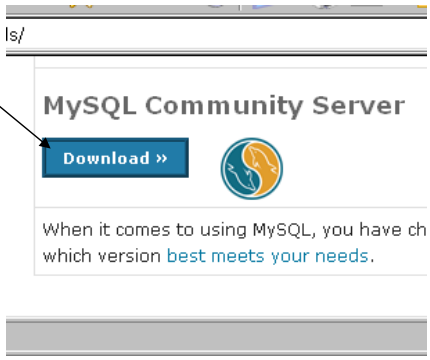
- Server stores results if query performed
- Program may then access those results



MySQL

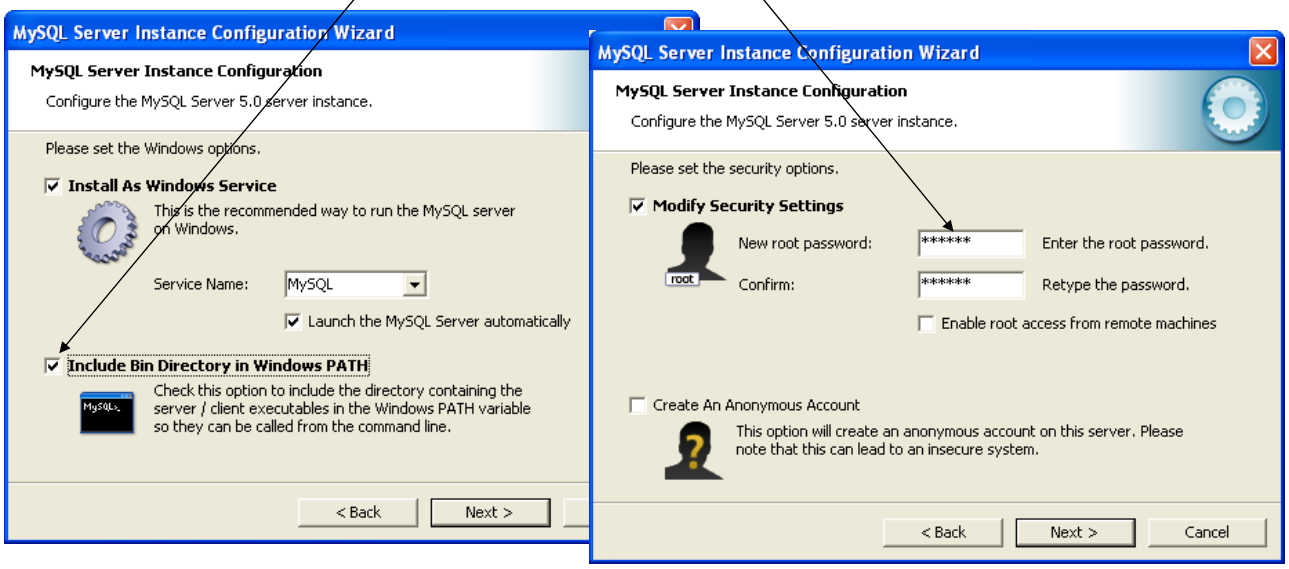
- Free database server
- See page 715 for instructions
  - Go to www.mysql.com
  - Follow downloads tab
  - Go to MySQL Community Server
  - Get Windows version
  - Pick a mirror
    - You can skip registration
  - Download and run





Installing MySQL

- Run the Service Instance Configuration when prompted to do so
- Should accept default settings
  - Check “Include Bin Directory”
  - Choose “sesame” for the root password



SQL and Databases

Commands to database server use SQL (structured query language)

Common examples:

- Query for all records matching some condition:
  `select field from table where condition`

  Example:
  ```
  select * from books where price < 10
  ```

- Delete all records matching some condition:
  `delete from table where condition`

  Example:
  ```
  delete from books where productCode = '0004'
  ```

SQL and Databases

- Set new field value for all records matching some condition:
  update *table* set *field* = *value* WHERE *condition*

  Example:
  update books set price = 9.95 where productCode = '0004'

- Insert new record with given field values:
  insert into *table* (*field*, *field*, *field*…)
  values (*value*, *value*, *value*…)
  Example:
  insert into books (productCode, title, price) values ('0004', 'Green Eggs and Ham', 9.95)

JDBC

- Java Database Connectivity:
  Java classes for database manipulation
  - Create connections to database via server
  - Create SQL statement objects
  - Execute statements to manipulate databases
  - Get results of queries
  - In **javax.sql.*** package

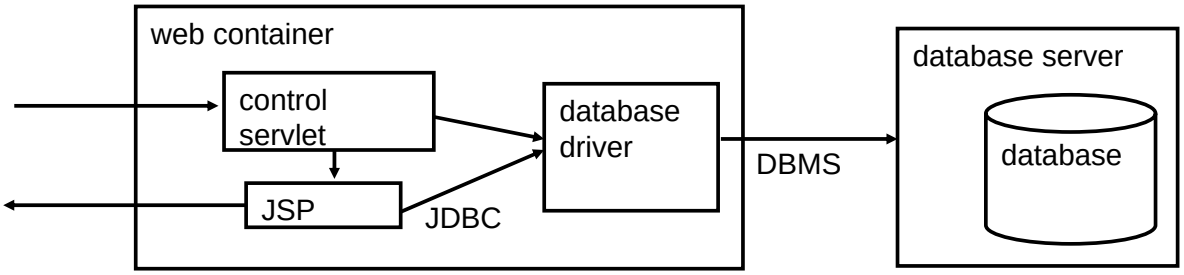
```
try {
  Class.forName("com.mysql.jdbc.Driver").newInstance();  // load the
  connection = DriverManager.getConnection(
                  "jdbc:mysql://localhost/TestDB", "john", "sesame");
  }
catch (ClassNotFoundException e) { %> NO DRIVER <% }
catch (SQLException e) { %> NO CONNECTION <% }

try {
  statement = connection.createStatement();
  books = statement.executeQuery("SELECT * FROM books");
  }
catch (SQLException e) { %> BAD QUERY <% }
catch (NullPointerException e) { %> NO CONNECTION ESTABLISHED <%  }
%>
```

```
<%
  while (books != null && books.next()) {
    String productCode = books.getString("productCode");
    String title = books.getString("title");
    double price = books.getDouble("price");
%>
```

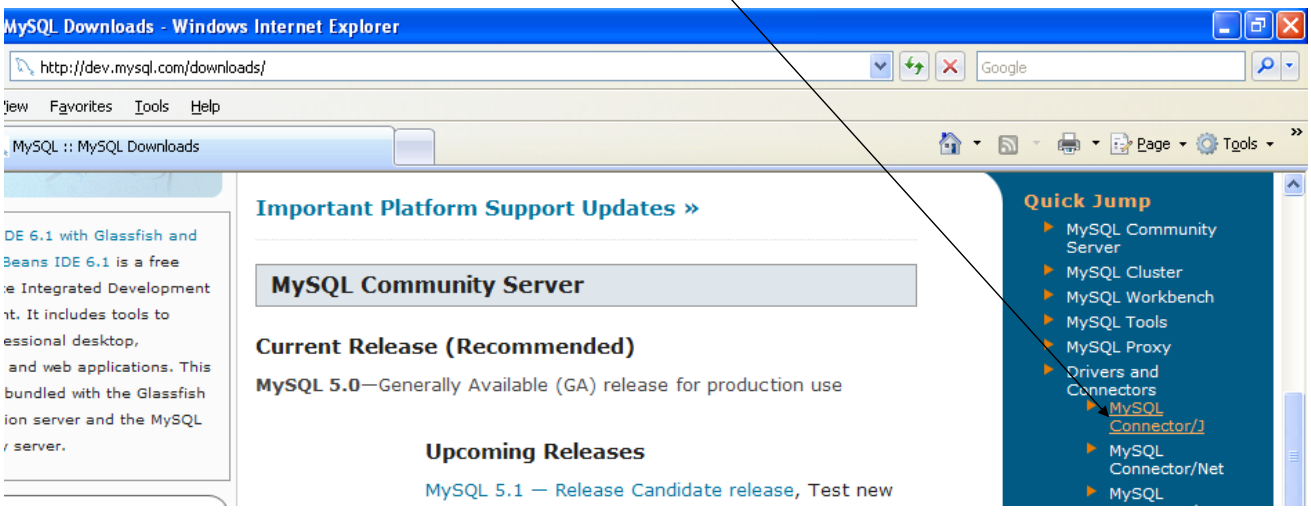
Database Drivers

- Database server does not understand JDBC commands
- Only understands its own DBMS protocols
  - Each server has its own DBMS
- Need a database driver to perform translation
  - Obtain from database server provider
  - Install in Java libraries



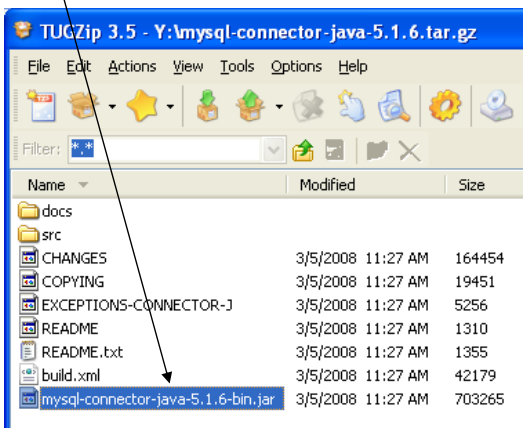
MySQL Database Driver

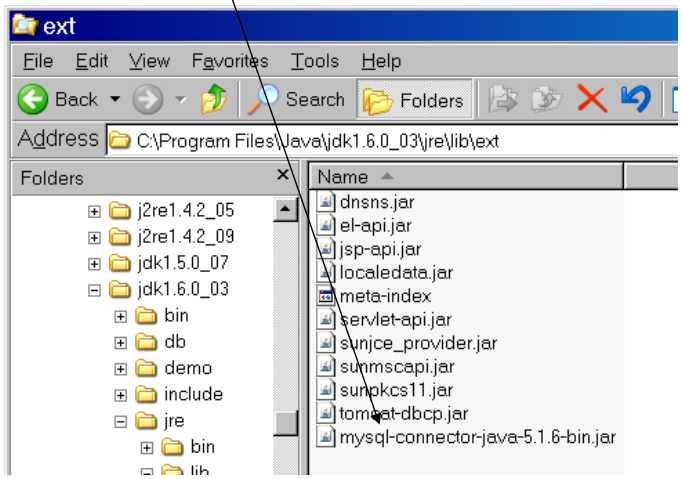
- From downloads page at mysql.com
- Go to MySQL Connector/J
- Download and save



MySQL Database Driver

- Extract the **`mysql-connector-java-5.1.6-bin.jar`** file
- Copy to jre\lib\ext directory of your Java
  - Same as you did with JSP/servlet libraries

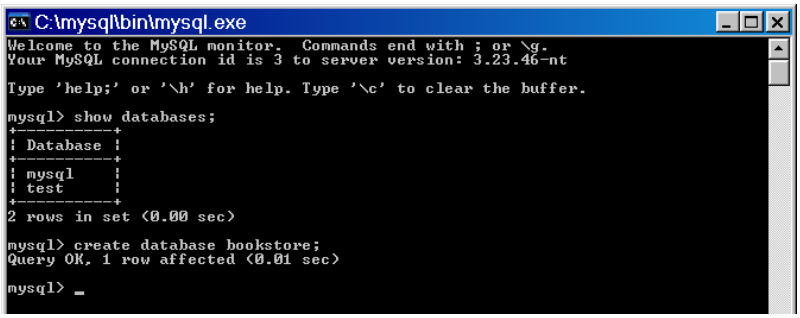




The MySQL Interface

- Command line interface to manipulate databases MySQL controls
  - Available from PROGRAMS menu
  - Will need to give password

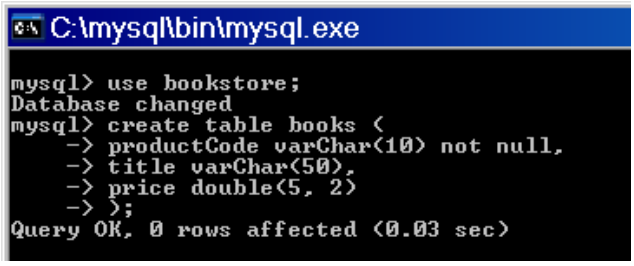
  - Can create new databases
    `create database databasename;`



Creating Database Tables

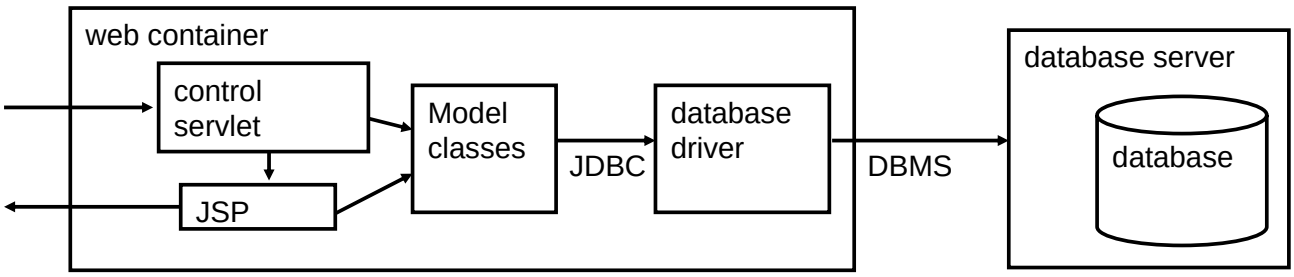
- Must define field names and field types
- Some types:
  - **varChar(*n*)** : String of up to ***n*** characters
  - **int(*n*)** : integer up to ***n*** digits
  - **double(*n, d*)** : decimal number up to ***n*** digits and ***d*** after the decimal
- By default, first field is key field
  - Must declare it as not null so all records will have a key field
- SQL command:

```
create table tablename (
keyfieldname type not null,
fieldname type,
fieldname type,
…
);
```



Databases and the MVC Paradigm

- Usually do not directly access database from JSPs/servlets
  - Requires both web programming and SQL knowledge
- Usually done in model classes
  - Cart object stores its content to database when commanded to
  - Cart object created from database query when need to retrieve the cart



Disaster Recovery

- Database server should be behind firewall to protect crucial data
  - May be on separate machine from web server!
- Database access may fail
  - Connection lost to database server, database server shuts down, etc.
- Need plan to back up any crucial data entered by user
  - Store to file if server not available
  - Read file contents into database later