Module 2 - Lecture 6

Database Connectivity

REVIEW

- Database Design
- Normalization
- Data Definition Language
- Data Control Language

How to connect?

- Our Java applications can act as a client to our database in the same way that DbVisualizer and PSQL do.

- We use a common interface provided by the Java language. It is termed Java Database Connectivity, or **JDBC**.

- The things that implement JDBC are called **drivers**. Drivers are written for each database type e.g. PostgreSQL, MSSQL, Oracle, MySQL, etc.

How to connect?

- First, we create a **connection**.
  - Connections use resources.
  - Often, there are a finite number of connections.
  - Connections should be closed, or else.

- We create connections using a **connection string**.
  - This tells the JDBC what it needs to know:
    - Driver to use
    - Database Server URL and port
    - Database to connect to
    - Username / Password to connect with

Anatomy of a Connection String

- Each type of database has its own format.

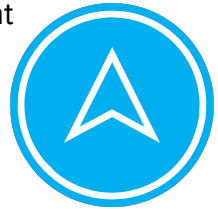
```
String connectionString =
"jdbc:postgresql://localhost/test?user=fred&password=
secret";
```

- Connections strings should **NOT** be written in our code!

Connection Pooling

- There is overhead associated with creating a connection. To limit the cost, we often ask that the JDBC keep a pool of open connections.

- To illustrate the cost of opening a connection, here is a summary of the steps involved.
  - An application invokes the *getConnection()* method.
  - The JDBC driver requests a JVM socket.
  - JVM has to ensure that the call does not violate security aspects (as the case may be with applets).
  - The invocation may have to percolate through a firewall before getting into the network cloud.
  - On reaching the host, the server processes the connection request.
  - The database server initializes the connection object and returns back to the JDBC client (again, going through the same process).
  - And, finally, we get a connection object.



We are connected, now what?

- We can begin to run SQL statements and get back results.

- Our statements should be **parameterized** to prevent SQL Injection attacks!
  - A parameterized query is a query in which placeholders are used for parameters and the parameter values are supplied at execution time.
  - The placeholder in Java is a “?” character.

```
SELECT *
FROM  actor
WHERE first_name = ? AND last_name = ?
```

LET'S CODE

JDBC Pattern Overview

- There are 4 main interfaces involved.

- **DataSource:** used to configure our connection string and ask for a Connection object.

- **Connection:** used to create SQL queries via Statement objects, and configure transactions.

- **Statement:** used for building and executing static SQL queries.
- **PreparedStatement:** an extension of Statement. Used for building and executing pre-compiled, parameterized queries.

- **ResultSet:** used for parsing the results of a Statement.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JDBCTemplate

- Provided by the popular Spring Java framework.

- Reduces 4 interfaces into 3.
  - **Data Source**: still necessary
  - **JdbcTemplate**: replacement for Connection and Statement/PreparedStatement
  - **RowSet**: replacement for ResultSet. Similar methods to ResultSet.

- Simplifies methods for executing queries.

- Transactions have to be handled differently, however.

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Data Access Object (DAO)

- A database table can sometimes map fully or partially to an existing class in Java. This is known as Object-Relational Mapping

- We implement Object Relational Mapping with a design pattern called DAO.

- The pattern uses interfaces so that changes to our data infrastructure results in minimal changes on our business logic.

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QUESTIONS?