

Selected Topics - Part III - Database Connectivity and Application Programming

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Outline

- 1 Recap and Project
 - Project
- 2 Outline of Selected Topics
- 3 Database Connectivity
 - Motivation
 - Database Connectivity
 - JDBC
- 4 Summary

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Reminder: Project Demo and Presentation

Are you ready for project demo and presentation?

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Selected Topics

Discussed

- ▶ an introduction to database index
- ▶ ACID and transactions

To discuss

- ▶ Database in programming environment – this is a recap.

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Motivation

How do we access the database in our own application programs, e.g.,

- ▶ in Java programs,
- ▶ in PHP programs,
- ▶ in JavaScript (NodeJS),
- ▶ in Python,
- ▶ in C/C++,
- ▶ in ...

Database Connectivity

It is the mechanisms through which application programs connect and communicate with data repositories.

It provides application programming interface, or database connectivity interface.

Database Connectivity Interface

Vendor provided and specific

- ▶ Native SQL connectivity

Standard

- ▶ Open Database Connectivity (ODBC), Data Access Objects (DAO), and Remote Data Objects (RDO) (by Microsoft)
- ▶ Object Linking and Embedding for Database (OLE-DB) (by Microsoft)
- ▶ ActiveX Data Objects (ADO.NET) (by Microsoft)
- ▶ Java Database Connectivity (JDBC) (by Oracle)
- ▶ ...

Java Database Connectivity (JDBC)

Take a look at,

- ▶ [Oracle's JDBC tutorial](#)
- ▶ [JDBC API documentation \(Java 8\)](#)
- ▶ [JDBC API documentation \(Java 17\)](#)

JDBC: Minimal Example (Recap)

```
import java.sql.Connection;
import java.sql.DriverManager;
import java.sql.PreparedStatement;
import java.sql.ResultSet;
import java.sql.SQLException;

public class Application {

    private static Connection conn;

    public static void main(String[] args) throws SQLException {
        try {
            System.out.println("Opening database connection...");

            // Is this a good way (think about security)?
            conn = DriverManager.getConnection(
                "jdbc:mariadb://your_db_host_ip:your_db_host_port/your_db",
                "your_db_user_name", "your_db_password"
            );

            readData();

            System.out.println("Connection valid: " + conn.isValid(0));
        } finally {
            if (conn != null) conn.close();
        }
    }
}
```

JDBC: Minimal Example

```
private static void readData() throws SQLException {  
    final String sql = "SELECT name, phone FROM Students";  
    try (PreparedStatement statement = conn.prepareStatement(sql)) {  
        try (ResultSet resultSet = statement.executeQuery()) {  
            while (resultSet.next()) {  
                String name = resultSet.getString("name");  
                String phone = resultSet.getString("phone");  
                System.out.println("\t>" + name + ": " + phone);  
            }  
        }  
    }  
}
```

Running the Example Program: JDBC Driver

Need to have a copy of the JDBC driver provided by the database vendor

- ▶ Most classes in `java.sql` package are abstract classes or interfaces.
- ▶ The driver provided by the vendor provided JDBC driver provides a concrete implementation of those abstract classes and interfaces

Running the Example Program: JDBC Driver

To compile and run the program, observe the following,

```
$ javac -d bin Application.java
$ CLASSPATH=bin:lib/mariadb-java-client-x.x.x.jar:./ \
  java Application
Opening database connection...
  > Amy Smith: 1112223335
  > Emma Doe: 123456789
  > Jane Doe: 1112223333
  > Amy Smith: 2222333111
  > Jane Doe: 9991113333
  > John Doe: 1112223333
  > John Smith: 9998881111
Connection valid: true
Connection closed
$
```

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Questions and Summary

- ▶ A brief introduction to database connectivity and JDBC