Module 2-6

The DAO Pattern

JDBC Basics
A Traditional Approach

JDBC Introduction

JDBC (Java Database Connectivity) is an API that is part of standard Java, made available to facilitate connections to a database.

- understand the collaborator classes and methods that will be needed to talk to a Postgresql database.

The DataSource Class

- The DataSource class is responsible for creating a connection to a database.
- There are 4 commonly used methods:
  - **.setURL(<<String with URL>>)**: Sets the network location of the database, it could be a localhost connection to a database on your own workstation.
  - **.setUsername**(**<<Username String>>**): Sets the username for the database.
  - **.setPassword**(**<<Password String>>**): Sets the password for the database.
  - **.getConnection()**: returns a connection object that will be used for running queries.

```
BasicDataSource dataSource = new BasicDataSource();
dataSource.setUrl("jdbc:postgresql://localhost:5432/dvdstore");
dataSource.setUsername("postgres");
dataSource.setPassword("postgres1");
```

The DataSource Class

Note:

There is a more elegant way to manage the credentials and connection strings. This will be a topic for when we discuss “Dependency Injection” in module 3.

The Connection Class

- The Connection class creates a session for any database transactions.
  - As a sidenote, typically connections are “pooled,” meaning they are storedwithin the JVM’s memory and reused during a given session. This is meant to reduce the amount of heavy lifting needed to establish a database connection.
- The connection object can be instantiated by simply having a DataSource object “pass the ball” through the aforementioned getConnection() method, like so:

```
Connection conn = dataSource.getConnection();
```

The Statement Class

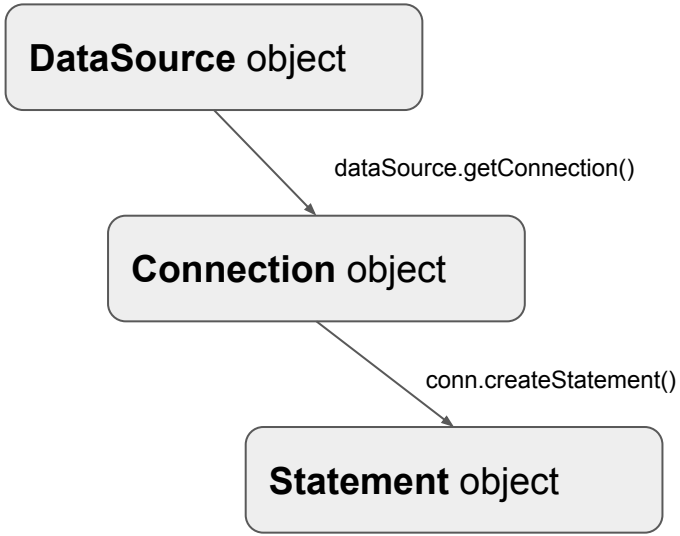
- The Statement object is responsible for the execution of the actual SQL command.
- The object can be instantiated by having the connection “pass the ball” with the createStatement method.

```
Statement stmt = conn.createStatement();
```

- The **.executeQuery**(**<<String containing SQL>>**) method is used to run the SQL command.

```
String aSQLStatement = “SELECT name from country”;
stmt.executeQuery(aSQLStatement);
```

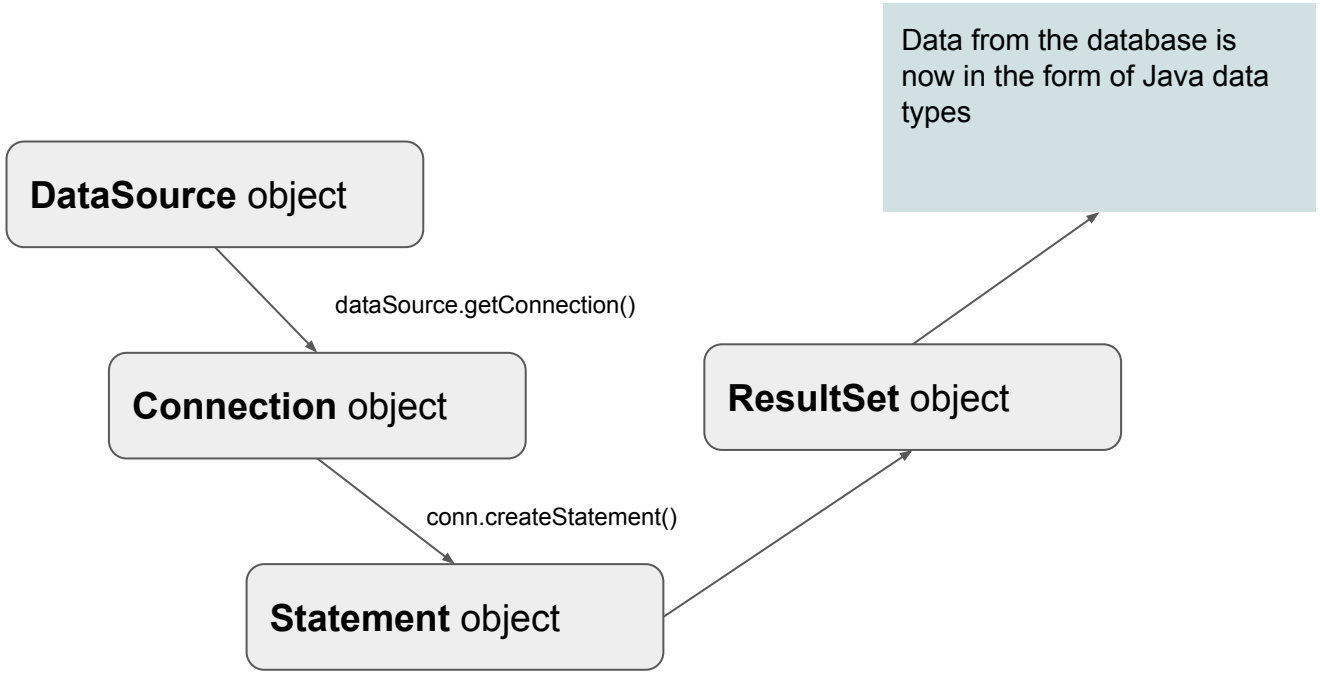
The story so far...



The ResultSet Class

- The ResultSet class is the collaborator in charge of storing the results from the query.
- It contains several meaningful methods:
  - **.next()**: This methods allows for iteration if the SQL operation returns multiple rows. Using next is very similar to the way we dealt with file processing.
  - **.getString**(**<<name of column in SQL result>>**) , **getInt**(**<<name of column in SQL result>>**), **getBoolean**(**<<name of column in SQL result>>**) ,etc. : These get the values for a given column, for a given row.

JDBC Flow


Data from the database is now in the form of Java data types
DataSource object
dataSource.getConnection()
Connection object
ResultSet object
conn.createStatement()
Statement object

Spring JDBC

Spring JDBC Introduction

The traditional JDBC approach requires multiple steps and collaborators, a process that is repetitive and could be error prone. The Spring JDBC pattern simplifies the process.

- Spring is a popular Java framework that abstracts various operations (i.e. querying a database) to a higher level such that it’s easier for developers to work with.
- Spring provides a **JDBCTemplate** class that accomplishes the previous operation in less lines of code.

JDBCTemplate Class

- The JDBC template's constructor requires a data source. You can pass it the same data source object described in the regular JDBC workflow:

```
BasicDataSource dataSource = new BasicDataSource();
dataSource.setUrl("jdbc:postgresql://localhost:5432/dvdstore");
dataSource.setUsername("postgres");
dataSource.setPassword("postgres1");

JdbcTemplate jdbcTemplate = new JdbcTemplate(dataSource)
```

JDBCTemplate Class

- The jdbcTemplate class encapsulates connection and datasource management.
- The .queryForRowSet(<<String containing SQL>>)method will execute the SQL query.
  - Extra parameter constructor are available as well, allowing for any prepared statement placeholders.

```
String sqlString = “SELECT name from country”;
SqlRowSet results = jdbcTemplate.queryForRowSet(sqlString);
```

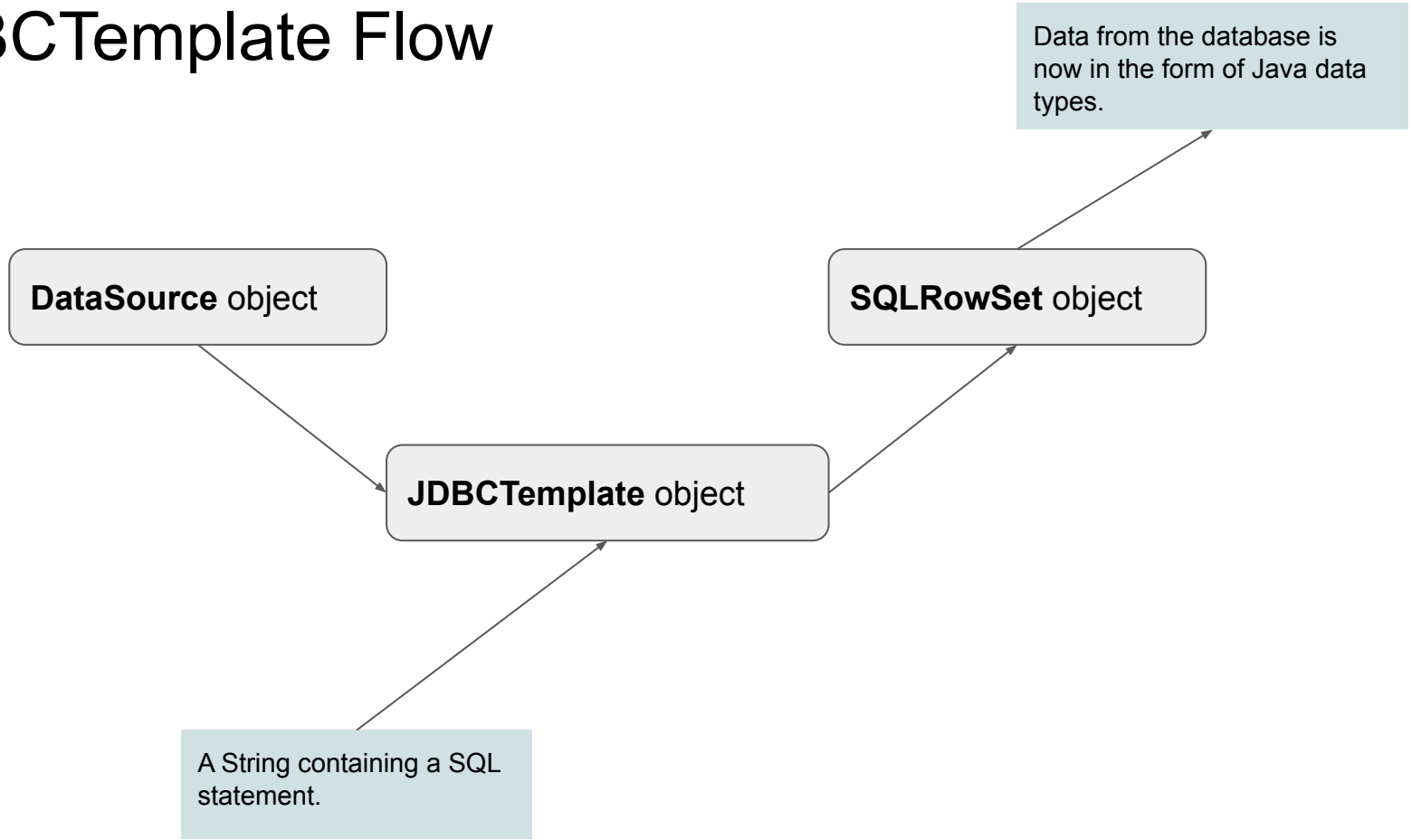
- For UPDATE, INSERT, and DELETE statements we will use the **.update** method instead of the .queryForRowSet method.

```
SqlRowSet results = jdbcTemplate.update(sqlString);
// Used whenthe  sqlString contains an UPDATE, INSERT, or DELETE.
```

JDBCTemplate Class

- The results are stored in an object of class SqlRowSet, this behaves the exact same way as a ResultSet object:
- The same methods available to ResultSet are also available here:
  - **.next()**: This methods allows for iteration if the SQL operation returns multiple rows. Using next is very similar to the way we dealt with file processing.
  - **.getString**(**<<name of column in SQL result>>**) , **getInt**(**<<name of column in SQL result>>**), **getBoolean**(**<<name of column in SQL result>>**) ,etc. : These get the values for a given column, for a given row.

JDBCTemplate Flow



DAO Pattern

DAO Pattern

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

- Object Relational Mapping is accomplished with a design pattern called DAO, which is short for **Data Access Object**.

- The DAO pattern also allows for loosely coupled systems by using Interfaces for database operations; future changes to our data infrastructure (i.e. migrating from 1 database platform to another) have minimal changes on the our business logic.

DAO Pattern Step 1

- Start with an Interface that will establish the contract for database communications. The method signatures will typically perform basic CRUD operations for that Object type (i.e. search, update, delete).

```
public interface CityDAO {

	public void save(City newCity);
	public City findCityById(long id);
}
```

DAO Pattern Step 2

- Next, we want to go ahead and create a concrete class that implements the DAO interface:

DAO Pattern Step 2

```
public class JDBCCityDAO implements CityDAO {

        private JdbcTemplate jdbcTemplate;

        public JDBCCityDAO(DataSource dataSource) {
                this.jdbcTemplate = new JdbcTemplate(dataSource);
        }

        @Override
        public void save(City newCity) {
                String sqlInsertCity = "INSERT INTO city(id, name, countrycode, district, population) " +
                                                                "VALUES(?, ?, ?, ?, ?)";
                newCity.setId(getNextCityId());
                jdbcTemplate.update(sqlInsertCity, newCity.getId(), newCity.getName(),newCity.getCountryCode(), newCity.getDistrict(),newCity.getPopulation());
        }

        @Override
        public City findCityById(long id) {
                City theCity = null;
                String sqlFindCityById = "SELECT id, name, countrycode, district, population "+
                                                                "FROM city "+
                                                                "WHERE id = ?";
                SqlRowSet results = jdbcTemplate.queryForRowSet(sqlFindCityById, id);
                if(results.next()) {
                        theCity = mapRowToCity(results);
                }
                return theCity;
        }
```

The contractual obligations of the interface are met.

DAO Pattern Step 3

- In our orchestrator class, we will be using a polymorphism pattern to declare our DAO objects:

```
CityDAO dao = new JDBCCityDAO(worldDataSource);
```

DAO Pattern Step 3

- In our orchestrator class, we will be using a polymorphism pattern to declare our DAO objects:

```
City smallville = new City();
smallville.setCountryCode("USA");
smallville.setDistrict("KS");
smallville.setName("Smallville");
smallville.setPopulation(42080);

dao.save(smallville);

City theCity = dao.findCityById(smallville.getId());
```

We can now call the methods that are defined in concrete class and required by the interface.

GoTo Lecture Code...