Java SQL Adapter

Overview

This tutorial is a continuation of Java Adapter (../../../server-side-development/java-adapter/) and assumes previous knowledge of the concepts described there.

Java adapters give developers control over connectivity to a back end. It is therefore the responsibility of the developer to ensure best practices regarding performance and other implementation details.

This tutorial covers an example of a Java adapter that connects to a MySQL back end to make CRUD (Create, Read, Update, Delete) operations on a `users` table, using REST concepts.

Prerequisite: This tutorial assumes knowledge of SQL.

Topics:

- Setting up the data source
- UserAdapterApplication
- UserAdapterResource
- Results
- Sample

Setting up the data source

The MobileFirst Server needs to be configured to connect to the MySQL server. Those configurations can be stored in the `server.xml` file.

To connect to a database, Java code needs a JDBC driver. For MySQL, the latest driver can be found on the Download Connector/J (http://dev.mysql.com/downloads/connector/j/) MySQL page, at `http://dev.mysql.com/downloads/connector/j/`.

This example uses the embedded application server of MobileFirst Studio.

```
<library id="MySQLLib">
  <fileset dir="${shared.resource.dir}" includes="mysql-*.jar" /
>
</library>
<dataSource jndiName="jdbc/mobilefirst_training">
  <jdbcDriver libraryRef="MySQLLib" />
  <properties databaseName="mobilefirst_training"
    password=""
    portNumber="3306"
    serverName="localhost"
    user="root" />
</dataSource>
```

- The `library` tag specifies where to find the `MySQL .jar` file. In most cases, `${shared.resource.dir}` is **shared/resources** under the Liberty server root folder.
  In MobileFirst Studio for Eclipse, select **Project Explorer > MobileFirst Development Server > shared > resources**.

- The `dataSource` tag specifies how to connect to the database. Write down the `jndiName` that you choose, because you will need it later.

UserAdapterApplication

`UserAdapterApplication` extends `MFPJAXRSApplication` and is a good place to trigger any initialization required by the adapter application.

```
@Override
protected void init() throws Exception {
    UserAdapterResource.init();
    logger.info("Adapter initialized!");
}
```

UserAdapterResource

```
@Path("/")
public class UserAdapterResource {

}
```

`UserAdapterResource` is where requests to the adapter are handled.

`@Path("/")` means that the resources will be available at the URL `http(s)://host:port/ProjectName/adapters/AdapterName/`.

Using DataSource

```
static DataSource ds = null;
static Context ctx = null;
public static void init() throws NamingException {
    ctx = new InitialContext();
    ds = (DataSource)ctx.lookup("jdbc/mobilefirst_training")
;
}
```

The `DataSource` is set as `static` so that it can be shared across all requests to the adapter. It is initialized in the `init()` method, which is called by the `init()` method of `UserAdapterApplication`, as described above.

The previously defined `jndiName` parameter is used to find the database configuration.

Create User

```
@POST
public Response createUser(@FormParam("userId") String userId, @FormParam("firstName") String fir
stName, @FormParam("lastName") String lastName, @FormParam("password") String password) thro
ws SQLException{
   Connection con = ds.getConnection();
   PreparedStatement insertUser = con.prepareStatement("INSERT INTO users (userId, firstName, last
Name, password) VALUES (?,?,?,?)");
   try{
    insertUser.setString(1, userId);
    insertUser.setString(2, firstName);
    insertUser.setString(3, lastName);
    insertUser.setString(4, password);
    insertUser.executeUpdate();
    //Return a 200 OK
    return Response.ok().build();
   }
   catch (SQLIntegrityConstraintViolationException violation) {
    //Trying to create a user that already exists
    return Response.status(Status.CONFLICT).entity(violation.getMessage()).build();
   }
   finally{
    //Close resources in all cases
    insertUser.close();
    con.close();
   }
}
```

Because this method does not have any `@Path`, it is accessible as the root URL of the resource. Because it uses `@POST`, it is accessible via `HTTP POST` only.

The method has a series of `@FormParam` arguments, which means that those can be sent in the HTTP body as `x-www-form-urlencoded` parameters.

It is also possible to pass the parameters in the HTTP body as JSON objects, by using `@Consumes(MediaType.APPLICATION_JSON)`, in which case the method needs a `JSONObject` argument, or a simple Java object with properties that match the JSON property names.

The `Connection con = ds.getConnection();` method gets the connection from the data source that was defined earlier.

The SQL queries are built by the `PreparedStatement` method.

If the insertion was successful, the `return Response.ok().build()` method is used to send a `200 OK` back to the client. If there was an error, a different `Response` object can be built with a specific HTTP status code. In this example, a `409 Conflict` error code is sent. It is advised to also check whether all the parameters are sent (not shown here) or any other data validation.

Important: Make sure to close resources, such as prepared statements and connections.

Get User

```
@GET
@Produces("application/json")
@Path("/{userId}")
public Response getUser(@PathParam("userId") String userId) throws SQLException{
   Connection con = ds.getConnection();
   PreparedStatement getUser = con.prepareStatement("SELECT * FROM users WHERE userId = ?");</
p>
   try{
    JSONObject result = new JSONObject();
    getUser.setString(1, userId);
    ResultSet data = getUser.executeQuery();
    if(data.first()){
     result.put("userId", data.getString("userId"));
     result.put("firstName", data.getString("firstName"));
     result.put("lastName", data.getString("lastName"));
     result.put("password", data.getString("password"));
     return Response.ok(result).build();
    } else{
     return Response.status(Status.NOT_FOUND).entity("User not found...").build();
    }
   }
   finally{
    //Close resources in all cases
    getUser.close();
    con.close();
   }
}
```

This method uses `@GET` with a `@Path("/{userId}")`, which means that it is available via `HTTP GET /adapters/UserAdapter/{userId}`, and the `{userId}` is retrieved by the `@PathParam("userId")` argument of the method.

If the user is not found, the `404 NOT FOUND` error code is returned.
If the user is found, a response is built from the generated JSON object.

Prepending the method with `@Produces("application/json")` makes sure that the `Content-Type` of the output is correct.

Get all users

This method is similar to `getUser`, except for the loop over the `ResultSet`.

```
@GET
@Produces("application/json")
public Response getAllUsers() throws SQLException{
   JSONArray results = new JSONArray();
   Connection con = ds.getConnection();
   PreparedStatement getAllUsers = con.prepareStatement("SELECT * FROM users")
;
   ResultSet data = getAllUsers.executeQuery();</p>
   while(data.next()){
    JSONObject item = new JSONObject();
    item.put("userId", data.getString("userId"));
    item.put("firstName", data.getString("firstName"));
    item.put("lastName", data.getString("lastName"));
    item.put("password", data.getString("password"));</p>
    results.add(item);
   }
   getAllUsers.close();
   con.close();
   return Response.ok(results).build();
}
```

Update user

```
@PUT
@Path("/{userId}")
public Response updateUser(@PathParam("userId") String userId, @FormParam("firstName") String fir
stName, @FormParam("lastName") String lastName, @FormParam("password") String password) thro
ws SQLException{
    Connection con = ds.getConnection();
    PreparedStatement getUser = con.prepareStatement("SELECT * FROM users WHERE userId = ?");
    try{
     getUser.setString(1, userId);
     ResultSet data = getUser.executeQuery();
     if(data.first()){
      PreparedStatement updateUser = con.prepareStatement("UPDATE users SET firstName = ?, lastNa
me = ?, password = ? WHERE userId = ?");
      updateUser.setString(1, firstName);
      updateUser.setString(2, lastName);
      updateUser.setString(3, password);
      updateUser.setString(4, userId);
      updateUser.executeUpdate();
      updateUser.close();
      return Response.ok().build();
     } else{
      return Response.status(Status.NOT_FOUND).entity("User not found...").build();
     }
    }
    finally{
     //Close resources in all cases
     getUser.close();
     con.close();
    }
    }
```

When updating an existing resource, it is standard practice to use `@PUT` (for `HTTP PUT`) and to use the resource ID in the `@Path`.

Delete user

```
@DELETE
@Path("/{userId}")
public Response deleteUser(@PathParam("userId") String userId) throws SQLException{
   Connection con = ds.getConnection();
   PreparedStatement getUser = con.prepareStatement("SELECT * FROM users WHERE userId = ?");
   try{
    getUser.setString(1, userId);
    ResultSet data = getUser.executeQuery();
    if(data.first()){
     PreparedStatement deleteUser = con.prepareStatement("DELETE FROM users WHERE userId = ?"
);
     deleteUser.setString(1, userId);
     deleteUser.executeUpdate();
     deleteUser.close();
     return Response.ok().build();
    } else{
     return Response.status(Status.NOT_FOUND).entity("User not found...").build();
    }
   }
   finally{
    //Close resources in all cases
    getUser.close();
    con.close();
   }
   }
```

`@DELETE` (for `HTTP DELETE`) is used together with the resource ID in the `@Path`, to delete a user.

Results

Use the testing techniques described in Java Adapter (../../../server-side-development/java-adapter/) to test your work.

Sample

Download the MobileFirst project (https://github.com/MobileFirst-Platform-Developer-Center/JavaAdapters) which includes the **UserAdapter** described here.

The project also includes a sample MySQL script in the **server** folder, which needs to be imported into your database to test the project.

The project does not include the MySQL connector driver, and does not include the **server.xml** configuration described above. Those steps need to be completed in order to use the sample.