Java SQL Adapter

Overview

Java adapters give developers control over connectivity to a back end system. 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.

Prerequisites:

- Make sure to read the Java Adapters (../) tutorial first.
- This tutorial assumes knowledge of SQL.

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Setting up the data source

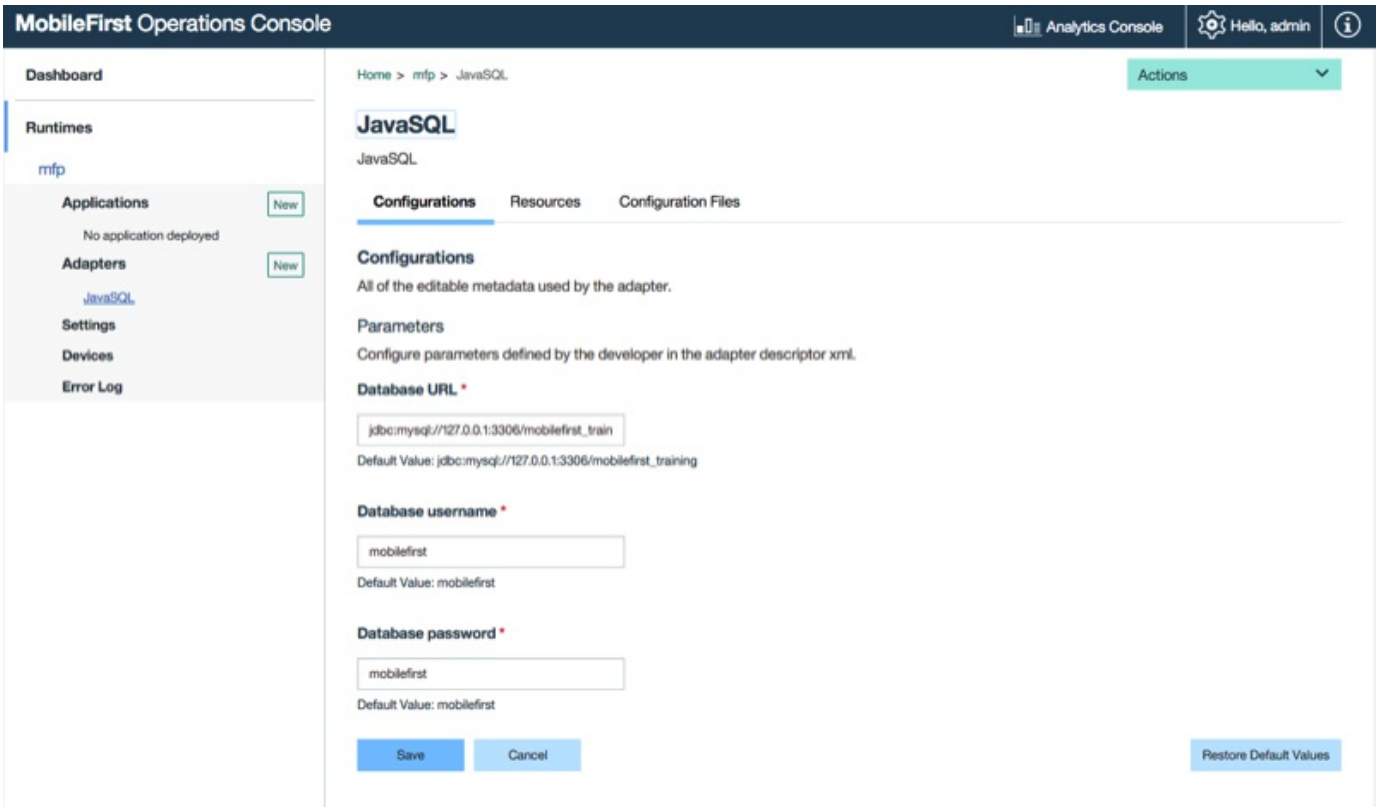
In order to configure the MobileFirst Server to be able to connect to the MySQL server, the adapter's XML file needs to be configured with **configuration properties**. These properties can later be edited through the MobileFirst Operations Console.

Edit the adater.xml file and add the following properties:

```
<mfp:adapter name="JavaSQL"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:mfp="http://www.ibm.com/mfp/integration"
    xmlns:http="http://www.ibm.com/mfp/integration/http">

    <displayName>JavaSQL</displayName>
    <description>JavaSQL</description>

    <JAXRSApplicationClass>com.sample.JavaSQLApplication</JAXRSApplicationClass>

    <property name="DB_url" displayName="Database URL" defaultValue="jdbc:mysql://127.0.0.1:3306/mo
bilefirst_training"  />
    <property name="DB_username" displayName="Database username" defaultValue="mobilefirst"  />
    <property name="DB_password" displayName="Database password" defaultValue="mobilefirst"  />
</mfp:adapter>
```

> **Note:** The configuration properties elements must always be located *below* the `JAXRSApplicationClass` element.
> Here we define the connection settings and give them a default value, so they could be used later in the AdapterResource class.

You can then view and configure these properties in the MobileFirst Operations Console:



Implemeting SQL in the adapter Resource class

The adapter Resource class is where requests to the server are handled.

In the supplied sample adapter, the class name is `JavaSQLResource`.

```
@Path("/")
  public class JavaSQLResource {
}
```

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

Using DataSource

Define static variables to hold the database connection properties so they can be shared across all requests to the server:

```
private static BasicDataSource ds = null;
private static String DB_url = null;
private static String DB_username = null;
private static String DB_password  = null;
```

Since we are using configuration properties that can be configured during runtime in the console - we need to check their values each time we intend to connect to the database:

```
private boolean updatedProperties() {
    // Check if the properties were changed during runtime (in the console)
    String last_url = DB_url;
    String last_username = DB_username;
    String last_password  = DB_password;

    DB_url = configurationAPI.getPropertyValue("DB_url");
    DB_username = configurationAPI.getPropertyValue("DB_username");
    DB_password = configurationAPI.getPropertyValue("DB_password");

    return !last_url.equals(DB_url) ||
           !last_username.equals(DB_username) ||
           !last_password.equals(DB_password);
}
```

This method will be called each time we intend to connect to the database, and if the properties have been changed - we set the `DataSource` configuration properties again accordingly:

```
public Connection getSQLConnection(){
  // Create a connection object to the database
  Connection conn = null;
  if(updatedProperties() || ds == null){
    ds= new BasicDataSource();
    ds.setDriverClassName("com.mysql.jdbc.Driver");
    ds.setUrl(DB_url);
    ds.setUsername(DB_username);
    ds.setPassword(DB_password);
  }
  try {
    conn = ds.getConnection();
  } catch (SQLException e) {
    e.printStackTrace();
  }
  return conn;
}
```

Create User

Used to create a new user record in the database.

```
@POST
public Response createUser(@FormParam("userId") String userId,
                        @FormParam("firstName") String firstName,
                        @FormParam("lastName") String lastName,
                        @FormParam("password") String password)
                             throws SQLException{

    Connection con = getSQLConnection();
    PreparedStatement insertUser = con.prepareStatement("INSERT INTO users (userId, firstName, lastNa
me, 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 = getSQLConnection();` 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

Retrieve a user from the database.

```
@GET
@Produces("application/json")
@Path("/{userId}")
public Response getUser(@PathParam("userId") String userId) throws SQLException{
    Connection con = getSQLConnection();
    PreparedStatement getUser = con.prepareStatement("SELECT * FROM users WHERE userId = ?");

    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 = getSQLConnection();
    PreparedStatement getAllUsers = con.prepareStatement("SELECT * FROM users");
    ResultSet data = getAllUsers.executeQuery();

    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"));

        results.add(item);
    }

    getAllUsers.close();
    con.close();

    return Response.ok(results).build();
}
```

Update user

Update a user record in the database.

```
@PUT
@Path("/{userId}")
public Response updateUser(@PathParam("userId") String userId,
                        @FormParam("firstName") String firstName,
                        @FormParam("lastName") String lastName,
                        @FormParam("password") String password)
                             throws SQLException{
   Connection con = getSQLConnection();
   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 = ?, lastN
ame = ?, 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 a user record from the database.

```
@DELETE
@Path("/{userId}")
public Response deleteUser(@PathParam("userId") String userId) throws SQLException{
    Connection con = getSQLConnection();
    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.

Sample adapter

Click to download (https://github.com/MobileFirst-Platform-Developer-Center/Adapters/tree/release80) the Adapters Maven project.

The Adapters Maven project includes the **JavaSQL** adapter described above.
Also included is an SQL script in the **Utils** folder, which needs to be imported into your database to test the project.

Sample usage

- Use either Maven or MobileFirst Developer CLI to build and deploy the adapter (../../creating-adapters/).
- To test or debug an adapter, see the testing and debugging adapters (../../testing-and-debugging-adapters) tutorial.