

# Java SQL Adapter

## Overview

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.

### Prerequisites:

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

### Jump to:

- 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 connector driver for the specific database type.

### server.xml

```
<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.
- 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

UserAdapterResource is where requests to the adapter are handled.

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

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

## Using DataSource

### UserAdapterResource

```
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 firstName,
                           @FormParam("lastName") String lastName,
                           @FormParam("password") String password)
                           throws SQLException{

    Connection con = ds.getConnection();
    PreparedStatement insertUser = con.prepareStatement("INSERT INTO users (userId, firstName, lastName, 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 = ?");

    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();

    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

```

@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 = 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 S
ET firstName = ?, lastName = ?, 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 us
ers 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 ###

## Sample application

Click to download (<https://github.com/MobileFirst-Platform-Developer-Center/JavaAdapters>) the MobileFirst project.

The sample includes the **UserAdapter** described here.

The Adapters project also includes a sample MySQL script in the **Utils** 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.