

# 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.

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## 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, 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 = 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 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
@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 the Testing and Debugging Adapters ([../testing-and-debugging-adapters](#)) tutorial.

## 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.