Java SE 8: Creating a Basic REST Web Service using Grizzly, Jersey, and Maven

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Before You Begin

Purpose

The purpose of this guide is an introduction to creating a Grizzly/Jersey REST web service that can be stored and distributed in a single JAR file.

Time to Complete

45 minutes

Background

Typically, when a developer thinks of creating a RESTful web service using Java, they assume that using a Java EE application server is the only way to create this type of application. However, there are simpler lightweight alternative methods for creating RESTful applications using Java SE. This tutorial demonstrates one such alternative using the Grizzly Web server along with the Jersey REST framework.

This tutorial covers the basics of creating a RESTful Grizzly/Jersey application with Maven. The application includes a simple data model to demonstrate how actual REST requests are processed. You create a web service class with annotations that converts your methods into callable REST URLs. Finally, you package your Java REST application into a single portable JAR file which can be executed pretty much anywhere.

Grizzly Web Server

Project Grizzly is a pure Java web service built using the NIO API. Grizzly's main use case is the web server component for the GlassFish application server. However, Grizzly’s goal is to help developers do much more that. With Grizzly you can build scalable and robust servers using NIO as well as offering extended framework components including Web Framework (HTTP/S), WebSocket, Comet, and more!

Jersey, REST and JAX-RS

Jersey RESTful Web Services framework is an open source, production quality framework for developing RESTful Web Services in Java. Jersey provides support for JAX-RS APIs and serves as a JAX-RS Reference Implementation. Jersey helps to expose your data in a variety of representation media types and abstracts away the low-level details of the client-server communication. Jersey simplifies the development of RESTful Web services and their clients in Java in a standard and portable way.

Representational State Transfer (REST) is a software architecture style for creating scalable web services. REST is a simpler alternative to SOAP and WSDL-based Web services and has achieved a great deal of popularity. RESTful systems communicate using the Hypertext Transfer Protocol (HTTP) using the same verbs (GET, POST, PUT, DELETE, etc.) that web browsers use to retrieve web pages and send data to remote servers.

The Java API for RESTful Web Services (JAX-RS) provides portable APIs for developing, exposing and accessing Web applications designed and implemented in compliance with principles of REST architectural style. The latest release (https://jcp.org/aboutJava/communityprocess/mrel/jsr339/index.html) of JAX-RS is version 2.0. The Jersey framework is the reference implementation of JAX-RS.

Scenario

The RESTful web service built in this tutorial is the start of a REST application for managing customer data. For this example, customer data is stored in a list. You will create a web method to return all the customers stored in the list and a method to search for a customer by ID. To keep things simple, all data is returned in a plain text format.

What Do You Need?

To follow along with this OBE, you must have the following software installed on your system.

- Maven 3.3.1 or later --> Download from https://maven.apache.org/ (https://maven.apache.org/)
- Java 8 u45 or later --> Download from http://www.oracle.com/technetwork/java/javase/downloads/index.html (http://www.oracle.com/technetwork/java/javase/downloads/index.html)
- NetBeans 8.0.2 --> Download from https://netbeans.org/ (https://netbeans.org/)

Installation Notes

Here are some tips related to the tools used for this OBE.

- **Running Maven the first time:** The first time you run Maven it will download all the required software needed for the current project. So the first time you compile a project, it may take a few minutes. Also by implication, you need a live Internet connection the first time you set up a project.
- Screenshots are taken from a Windows system, but the steps outlined in this tutorial should work with minimal modifications on Linux or Mac OS X.

Creating the Maven Project

The first step in the process of creating a Grizzly/Jersey application is to create a Maven project. An archetype exists for this type of application. To create the project follow these steps:

1. Navigate to the directory where you want to create a new Grizzly/Jersey project. For example, `c:\examples`

2. Execute the following command to create an empty project:

```
mvn archetype:generate -DarchetypeArtifactId=jersey-quickstart-grizzly2 -DarchetypeG
roupId=org.glassfish.jersey.archetypes -DinteractiveMode=false -DgroupId=com.exampl
e.rest -DartifactId=jersey-service -Dpackage=com.example.rest -DarchetypeVersion=2.1
7
```

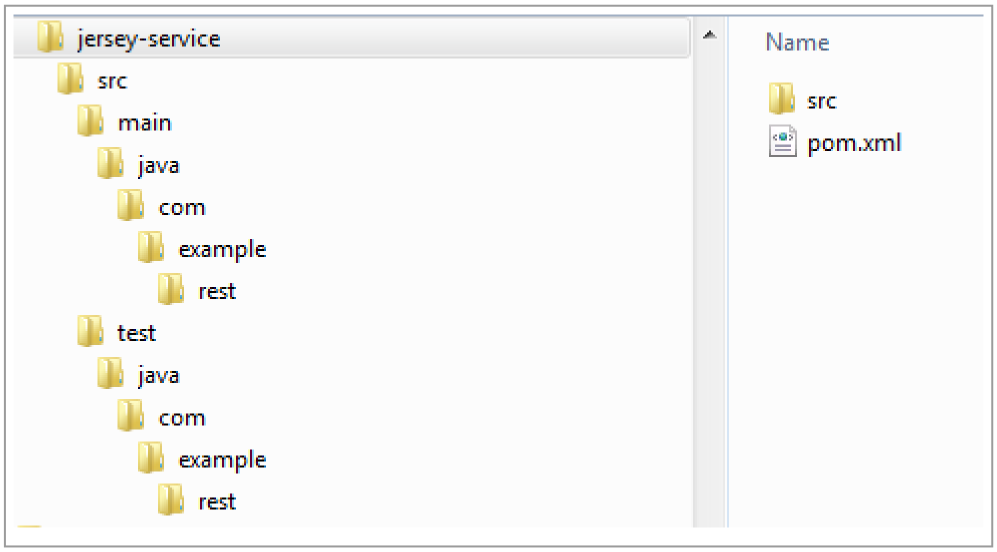
Note: If you are using a proxy server, see the following page on configuring Maven to use a proxy server (https://maven.apache.org/guides/mini/guide-proxies.html).

Note: You can change the various options in the command. Here is a brief breakdown of the options.

- **archetypeArtifactId:** Specifies the kind of project to create.
- **archetypeGroupId:** Specifies which group this archetype is defined in.
- **groupId:** Used to uniquely identify the project. Should be based on your domain name. Typically matches your package name.
- **artifactId:** The name of your project. This also specifies what the project archive files (e.g., jar or war) will be named.

3. The result of the command is a `jersey-service` directory with the project files included within.

The structure of the project looks like this.



```
jersey-service
  src
    main
      java
        com
          example
            rest
    test
      java
        com
          example
            rest
```

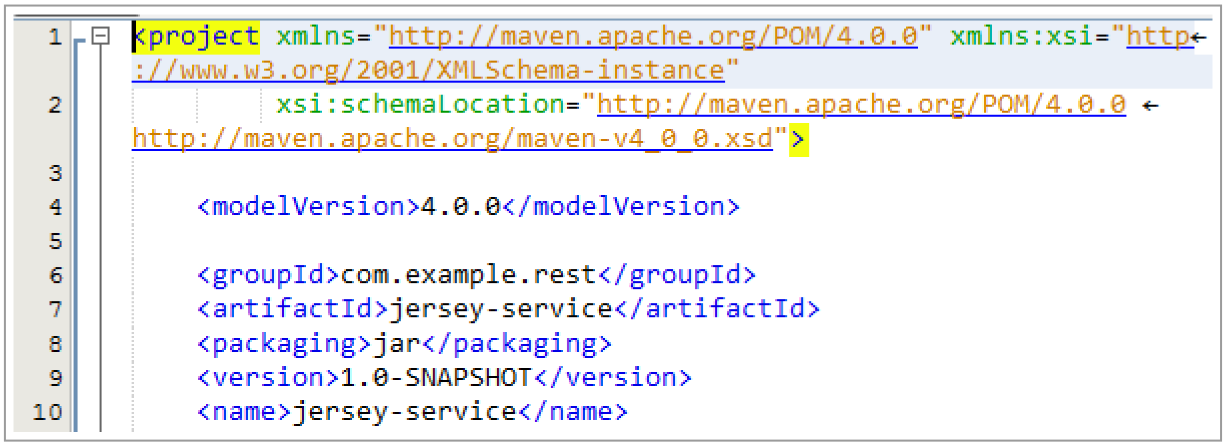
Maven Project Structure (files/project-structure.txt)

Note: You can open the project in NetBeans (File -> Open project) or in Eclipse (File -> Import -> Maven-> Existing Maven Project) but Maven must be setup correctly in your IDE.

Examining `pom.xml`

When you created the main project, you also created the main configuration file, `pom.xml` . This file specifies dependencies and versions required to build the project. Below is the file contents in 3 parts.

1. The first part of the file contains much of the project metadata you specified on the command line.

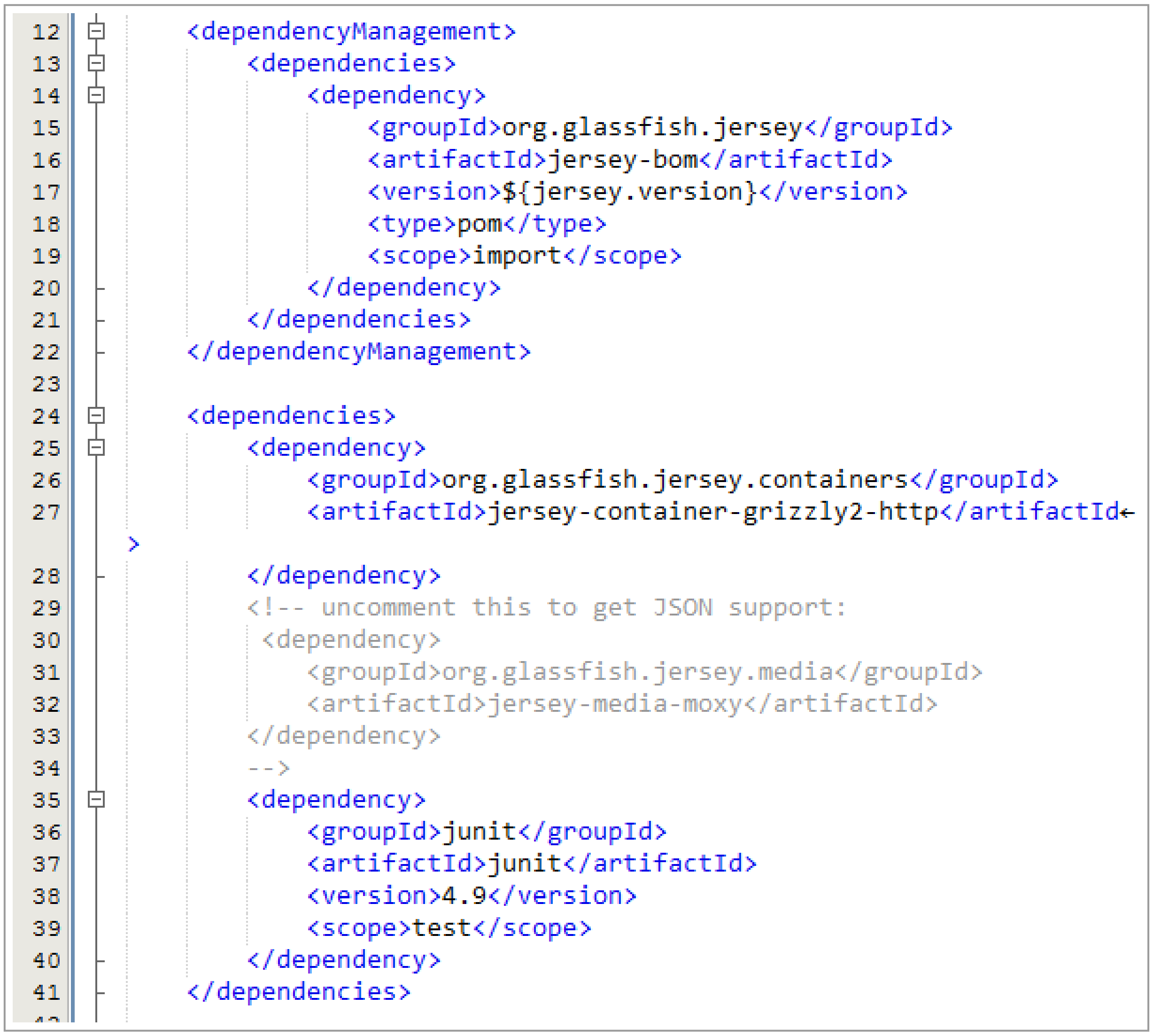


```
<project xmlns="http://maven.apache.org/POM/4.0.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
        xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 http://maven.apache.org/maven-v4_0_0.xsd">

    <modelVersion>4.0.0</modelVersion>

    <groupId>com.example.rest</groupId>
    <artifactId>jersey-service</artifactId>
    <packaging>jar</packaging>
    <version>1.0-SNAPSHOT</version>
    <name>jersey-service</name>
```

pom.xml (files/pom-orig.xml.txt)

Note the groupId and artifactId are specified here. The `name` tag identifies the name of the project. The artifactId is used to create the jar or war file name along with the text in the `version` tag. For example, this project will create a jar file named `jersey-service-1.0-SNAPSHOT.jar` .

2. The second part of the file contains the code dependencies required for the project.



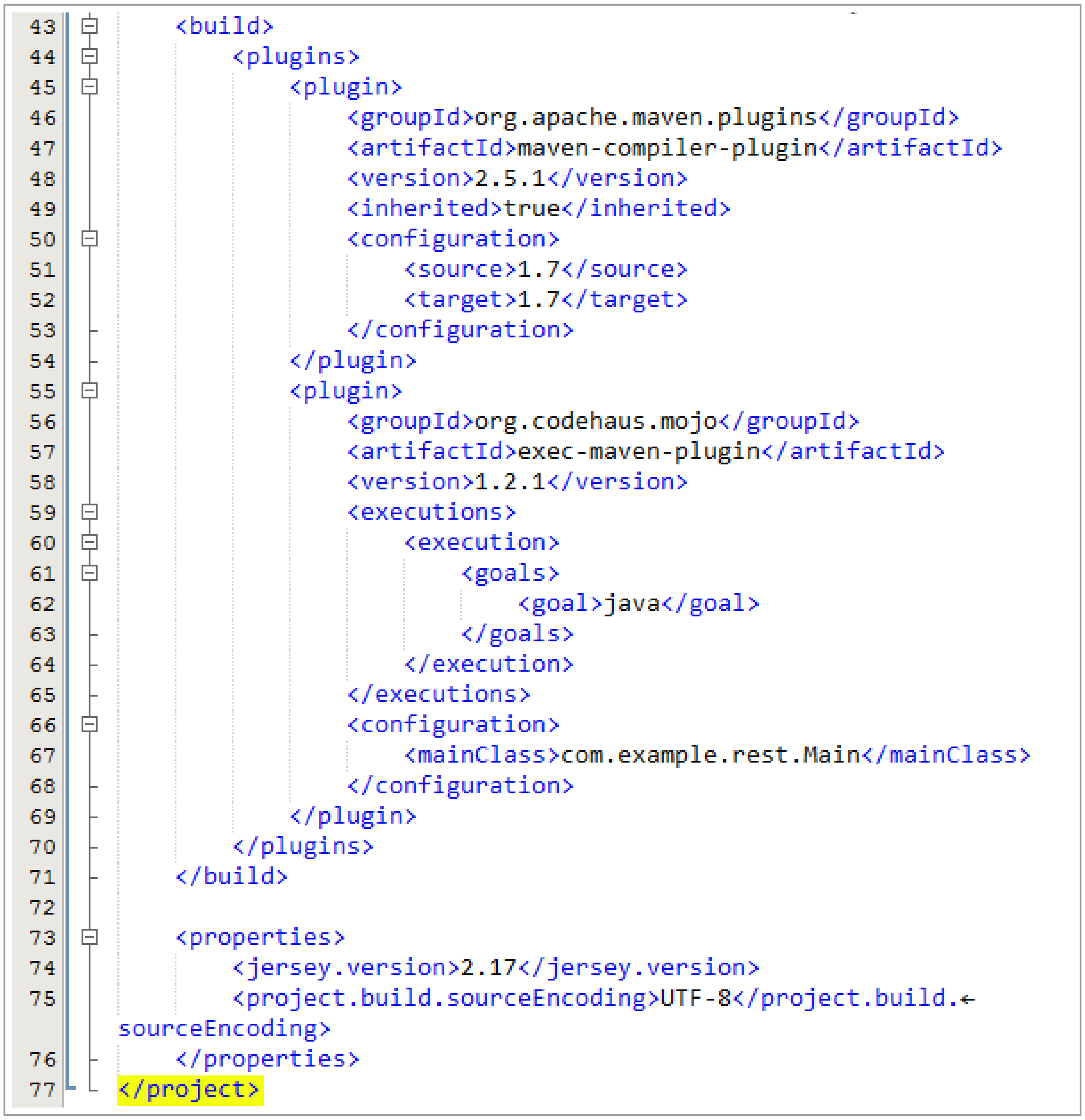
```
    <dependencyManagement>
        <dependencies>
            <dependency>
                <groupId>org.glassfish.jersey</groupId>
                <artifactId>jersey-bom</artifactId>
                <version>${jersey.version}</version>
                <type>pom</type>
                <scope>import</scope>
            </dependency>
        </dependencies>
    </dependencyManagement>

    <dependencies>
        <dependency>
            <groupId>org.glassfish.jersey.containers</groupId>
            <artifactId>jersey-container-grizzly2-http</artifactId>
        </dependency>
        <!-- uncomment this to get JSON support:
         <dependency>
            <groupId>org.glassfish.jersey.media</groupId>
            <artifactId>jersey-media-moxy</artifactId>
        </dependency>
        -->
        <dependency>
            <groupId>junit</groupId>
            <artifactId>junit</artifactId>
            <version>4.9</version>
            <scope>test</scope>
        </dependency>
    </dependencies>
```

pom.xml (files/pom-orig.xml.txt)

A couple of comments on the `dependencies` section:

- The `dependencyManagement` tag contains libraries that other dependencies depend upon. In this case, the Jersey REST library is specified.
- The first dependency provides containers for loading Jersey classes in the Grizzly web server.
- The second dependency specifies the JUnit library for unit testing.

3. Here is the third part of the file.



```
    <build>
        <plugins>
            <plugin>
                <groupId>org.apache.maven.plugins</groupId>
                <artifactId>maven-compiler-plugin</artifactId>
                <version>2.5.1</version>
                <inherited>true</inherited>
                <configuration>
                    <source>1.7</source>
                    <target>1.7</target>
                </configuration>
            </plugin>
            <plugin>
                <groupId>org.codehaus.mojo</groupId>
                <artifactId>exec-maven-plugin</artifactId>
                <version>1.2.1</version>
                <executions>
                    <execution>
                        <goals>
                            <goal>java</goal>
                        </goals>
                    </execution>
                </executions>
                <configuration>
                    <mainClass>com.example.rest.Main</mainClass>
                </configuration>
            </plugin>
        </plugins>
    </build>

    <properties>
        <jersey.version>2.17</jersey.version>
        <project.build.sourceEncoding>UTF-8</project.build.←
sourceEncoding>
    </properties>
</project>
```

pom.xml (files/pom-orig.xml.txt)

The `build` section of the file contains information about plugins required for the application.

- The `maven-compiler-plugin` compiles code for the project. The default Java version is 1.7. **Note:** Change this value to 1.8 so Lambda expressions can be used in the application. Then save the file.
- The `exec-maven-plugin` specifies how to execute the application. Notice the reference to the `Main` class use to execute the application.
- Note the `properties` tag near the end of the file allows the specification of application wide properties.

Examining the Source files

Two source files are created for this archetype. Both files are shown below with comments.

1. The `Main` class starts the application execution by setting up the web server. Any Jersey annotated classes found in the `com.example.rest` package are loaded.

`Main.java`

```
package com.example.rest;

import org.glassfish.grizzly.http.server.HttpServer;
import org.glassfish.jersey.grizzly2.httpserver.GrizzlyHttpServerFactory;
import org.glassfish.jersey.server.ResourceConfig;

import java.io.IOException;
import java.net.URI;

public class Main {
    // Base URI the Grizzly HTTP server will listen on
    public static final String BASE_URI = "http://localhost:8080/myapp/";

    public static HttpServer startServer() {
        // create a resource config that scans for JAX-RS resources and providers
        // in com.example.rest package
        final ResourceConfig rc = new ResourceConfig().packages("com.example.rest");

        // create and start a new instance of grizzly http server
        // exposing the Jersey application at BASE_URI
        return GrizzlyHttpServerFactory.createHttpServer(URI.create(BASE_URI), rc);
    }

    public static void main(String[] args) throws IOException {
        final HttpServer server = startServer();
        System.out.println(String.format("Jersey app started with WADL available at "
                + "%sapplication.wadl\nHit enter to stop it...", BASE_URI));
        System.in.read();
        server.stop();
    }
}
```

A couple of key points.

- The `BASE_URI` field specifies where the REST method you define will be appended. In this case, any methods created will be listed under `myapp` .
- The `ResourceConfig` class specifies which package contains annotated Jersey classes to be loaded.
- In the `main` method the HTTP server is started and run until the enter key is pressed.

2. The `MyResource` class defines the methods for a web service.

`MyResource.java`

```
package com.example.rest;

import javax.ws.rs.GET;
import javax.ws.rs.Path;
import javax.ws.rs.Produces;
import javax.ws.rs.core.MediaType;

/* Root resource (exposed at "myresource" path) */
@Path("myresource")
public class MyResource {

    @GET
    @Produces(MediaType.TEXT_PLAIN)
    public String getIt() {
        return "Got it!";
    }
}
```

The class contains only a `getIt` method. When this method is called, a text message should be returned: `Got it!`

The method is called when a `GET` method is made against the `http://localhost:8080/myapp/myresource` URL.

Running the Web Service

With the project setup, Maven can now be used to run the application and start the web server. Here are the steps to make that happen.

1. Open a `Terminal` or `Command Prompt` window.
2. Change into the project directory: `cd C:\examples\jersey-service`
3. Compile the project: `mvn clean compile`
4. Execute the project: `mvn exec:java`

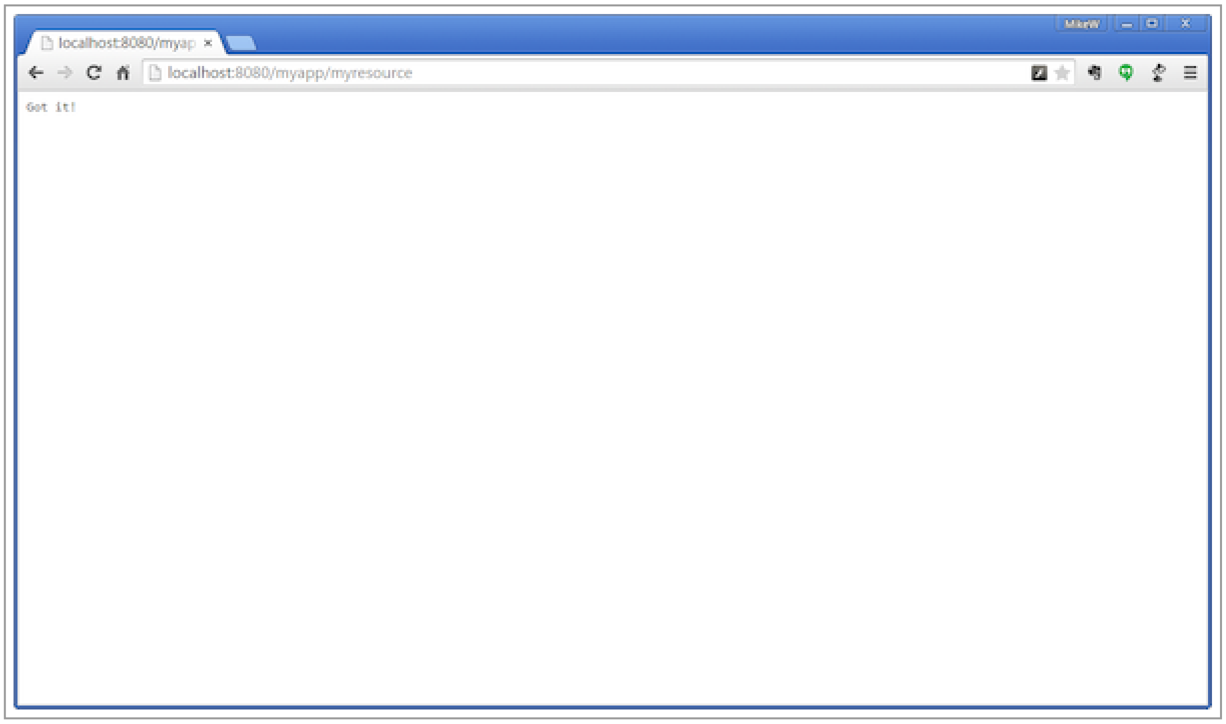
The output produced from this command may vary a bit, especially the first time you run the command. However, if you look at the end of the output, you should see something similar to the following:

```
C:\examples\jersey-service>mvn exec:java
[INFO] Scanning for projects...
[INFO]
[INFO] ------------------------------------------------------------------------
[INFO] Building jersey-service 1.0-SNAPSHOT
[INFO] ------------------------------------------------------------------------
[INFO]
[INFO] >>> exec-maven-plugin:1.2.1:java (default-cli) > validate @ jersey-servic
e >>>
[INFO]
[INFO]
[INFO] --- exec-maven-plugin:1.2.1:java (default-cli) @ jersey-service ---
Apr 30, 2015 5:26:05 PM org.glassfish.grizzly.http.server.NetworkListener start
INFO: Started listener bound to [localhost:8080]
Apr 30, 2015 5:26:05 PM org.glassfish.grizzly.http.server.HttpServer start
INFO: [HttpServer] Started.
Jersey app started with WADL available at http://localhost:8080/myapp/applicatio
n.wadl
Hit enter to stop it...
```

This indicates that the Grizzly web service is running with the Jersey REST web service. Now you can test the web service using a web browser.

1. Open the Firefox or Chrome web browser.
2. Enter the following URL into the browser address window and open the URL:

The output in your browser should look something like this:



```
Got it!
```

Chrome Window with http://localhost:8080/myapp/myresource URL

Notice that the "Got it!" text is returned to the browser.

Creating a Customer Web Service

To make the application a little more interesting, we can add some sample customer data to our project. Then, the source files can be modified to look up a an individual customer or the complete list of customers.

Adding Customer Data

The customer data consists of two classes. The `Customer.java` class uses the builder pattern to represent customer data. The `CustomerList.java` class creates a list of customers using sample data.

1. Add the `Customer.java` class to the project.

   Customer.java - Fragment

```
public class Customer {
  private final long id;
  private final String firstName;
  private final String lastName;
  private final String email;
  private final String city;
  private final String state;
  private final String birthday;
```

This code fragment shows the fields used in the customer class. A `long` is used to store the id field. The other fields are strings.

Copy the complete `Customer.java` file from this link (files/Customer.java.txt).

2. Add the `CustomerList.java` class to the project.

   CustomerList.java - Fragment

```
  static {
    // Create list of customers
    cList.add(
        new Customer.CustomerBuilder().id()
        .firstName("George")
        .lastName("Washington")
        .email("gwash@example.com")
        .city("Mt Vernon")
        .state("VA")
        .birthday("1732-02-23")
        .build()
    );

    cList.add(
        new Customer.CustomerBuilder().id()
        .firstName("John")
        .lastName("Adams")
        .email("jadams@example.com")
        .city("Braintree")
        .state("MA")
        .birthday("1735-10-30")
        .build()
    );

    cList.add(
        new Customer.CustomerBuilder().id()
        .firstName("Thomas")
        .lastName("Jefferson")
        .email("tjeff@example.com")
        .city("CharlottesVille")
        .state("VA")
        .birthday("1743-04-13")
        .build()
    );

    // More code here
}
```

Each customer is added to the list using a fluent approach. A total of 5 customers are added to the list.

Copy the complete `CustomerList.java` Java file from this link (files/CustomerList.java.txt).

Adding the Web Service Code

With the customer data created, now the web service code can be added to the application.

1. Create the `CustomerService.java` class.

   CustomerService.java

   ```
   package com.example.rest;

   import java.util.Optional;
   import java.util.concurrent.CopyOnWriteArrayList;
   import java.util.stream.Collectors;
   import javax.ws.rs.GET;
   import javax.ws.rs.Path;
   import javax.ws.rs.PathParam;
   import javax.ws.rs.Produces;
   import javax.ws.rs.core.MediaType;

   @Path("/customers")
   public class CustomerService {

     private final CopyOnWriteArrayList<Customer> cList = CustomerList.getInstance();



   }
   ```

   To setup a simple web service, the above `CustomerService` class will be used. The class includes a number of imports and starts with an annotation: `@Path("/customers")`. This specifies that the methods called in this class will appear under the `/customers` path. This means that for our application, method calls will appear under the `http://localhost:8080/myapp/customers` path. The customer list is created and stored in `cList`. Next, two methods will be added to this class.

2. Add the `getAllCustomers` Method

   The `getAllCustomers` method will return all the customers in our list. The following is the source code for this method.

```
@GET
@Path("/all")
@Produces(MediaType.TEXT_PLAIN)
public String getAllCustomers() {
  return "---Customer List---\n"
      + cList.stream()
      .map(c -> c.toString())
      .collect(Collectors.joining("\n"));
}
```

There are a number of annotations for this method. Here are some comments on the code.

- `@GET` - This method is called with the HTTP GET method.
- `@Path("/all")` - Specifies the path used to call this method. In this case calling `http://localhost:8080/myapp/customers/all` will return the list of customers in a text format.
- `@Produces(MediaType.TEXT_PLAIN)` - Specifies output data will be returned in a text format. Other formats could be specified here including JSON or XML.
- Lambda - The lambda expression at the end of the class get the list of customers, converts those object to strings, and then uses `Collectors.joining("\n")` to return a single string.

3. Add the `getCustomer` Method

The `getCustomer` method searches for a customer in the list and returns the customer information if the item is found. If not found, an error message is returned.

```
@GET
@Path("{id}")
@Produces(MediaType.TEXT_PLAIN)
public String getCustomer(@PathParam("id") long id) {
  Optional<Customer> match
      = cList.stream()
      .filter(c -> c.getId() == id)
      .findFirst();
  if (match.isPresent()) {
    return "---Customer---\n" + match.get().toString();
  } else {
    return "Customer not found";
  }
}
```

The following are the comments for this method.

- `@GET` - This method is called with the HTTP GET method.
- `@Path("{id}")` - Specifies the path used to call this method. In this case passing a `long` in the URL `http://localhost:8080/myapp/customers/101` turns the value 101 into an `id` variable. The `{id}` makes the value specified available as a parameter.
- `@Produces(MediaType.TEXT_PLAIN)` - Specifies output data will be returned in a text format. Other formats could be specified here including JSON or XML.
- `getCustomer(@PathParam("id") long id)` - This is where the `id` parameter that was specified in the `Path` annotation is turned into a `long` variable and passed to the method.
- *Method source* - The method uses a lambda expression to search for the specified ID. If found, the customer data is returned. If not found, an error message is returned.

Complete `CustomerService.java` Listing (files/CustomerService.java.txt)

Now the components of this web service have been created. The next section shows how to test the web service.

Testing the Web Service

To test the new web service follow these steps.

Starting Grizzly/Jersey Web Service

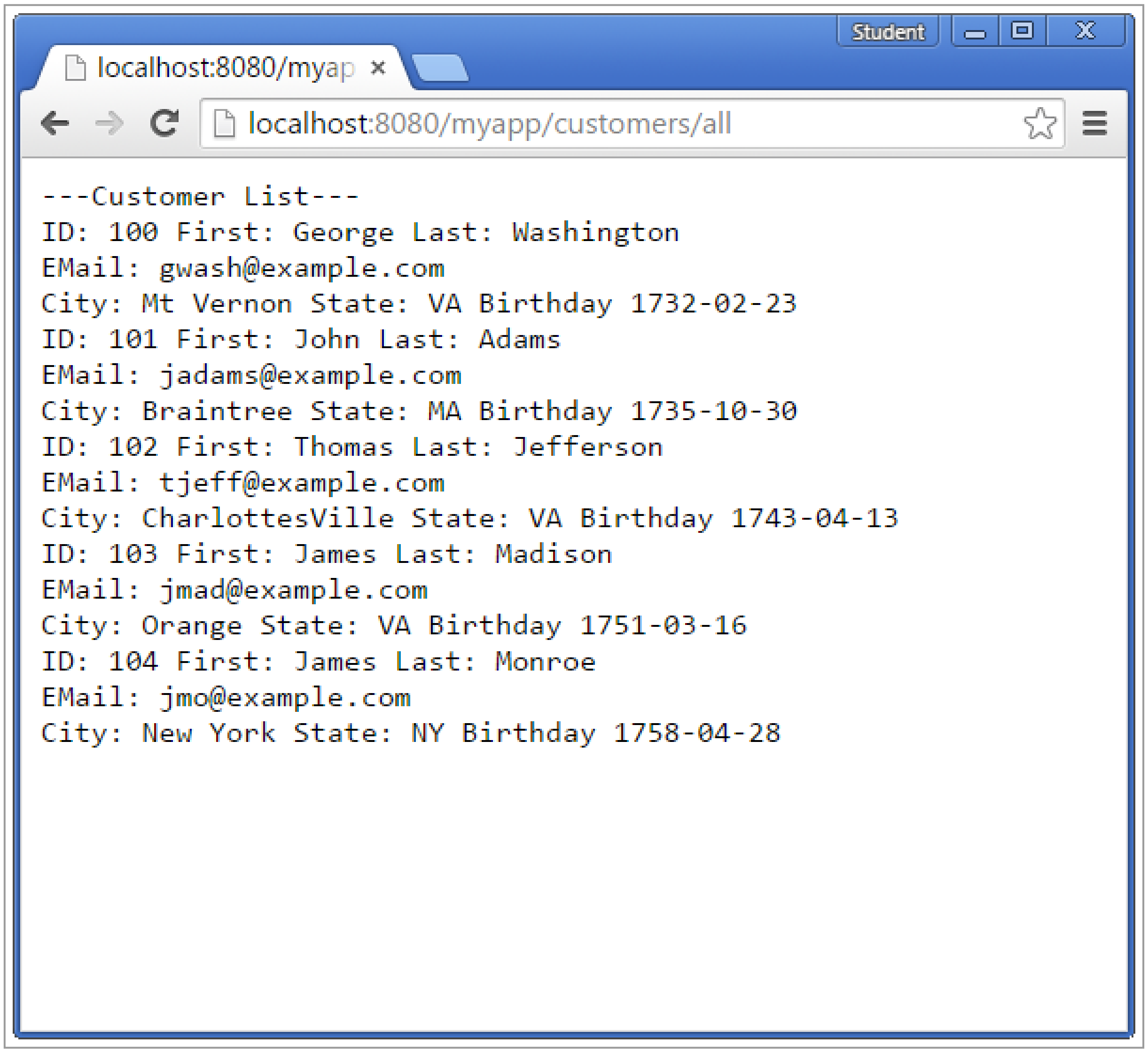
If your Grizzly server is still running stop it by pressing `Enter`. Complete the following steps to recompile the application and restart the Grizzly server.

1. Open a `Terminal` or `Command Prompt` window.
2. Change into the project directory: `cd C:\examples\jersey-service`
3. Compile the project: `mvn clean compile`
4. Execute the project: `mvn exec:java`

Testing in your Browser

To test the web service, start a browser. In this example, Google Chrome is used.

1. Enter this address in the address bar: `http://localhost:8080/myapp/customers/all`

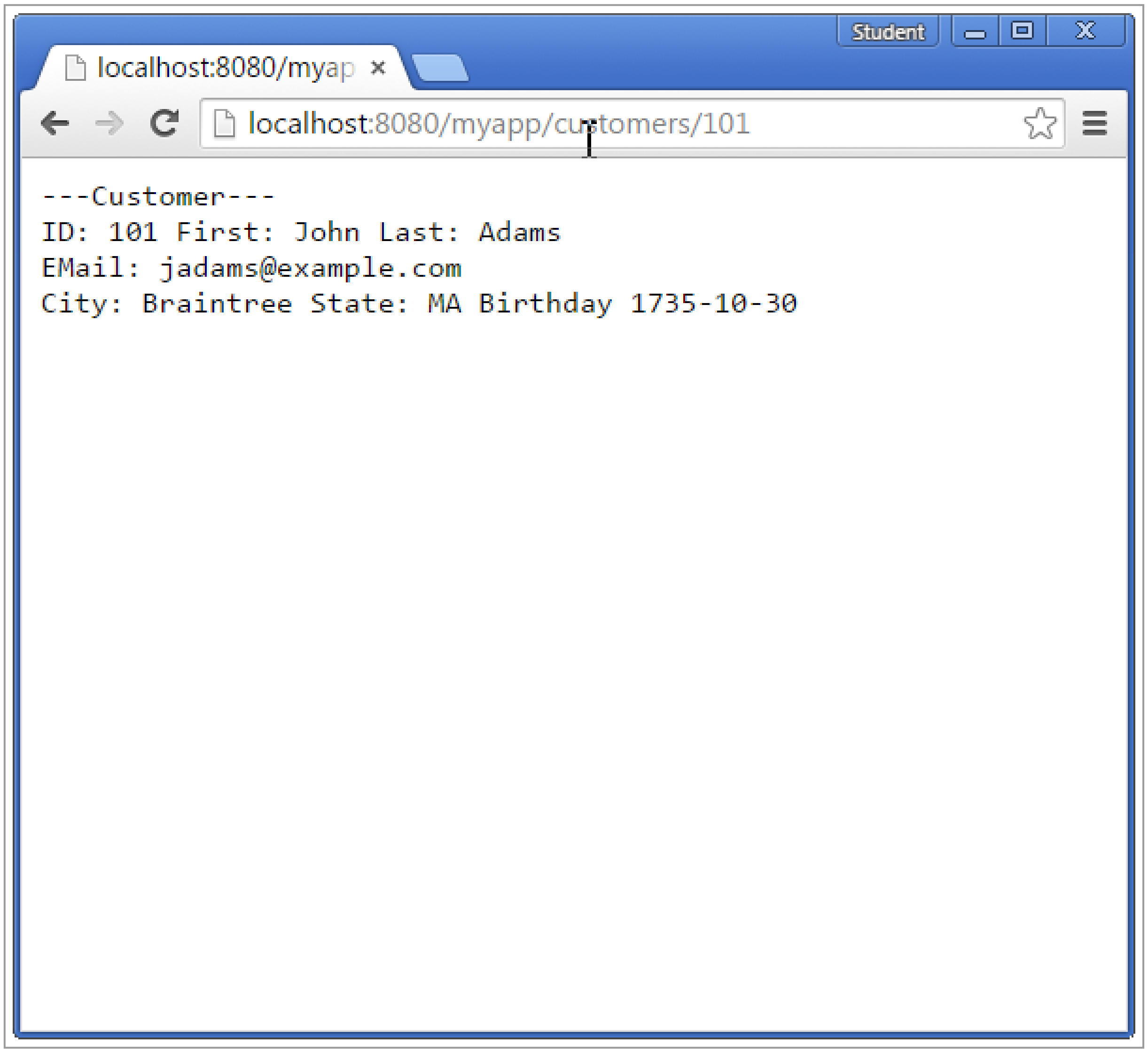


```
---Customer List---
ID: 100 First: George Last: Washington
EMail: gwash@example.com
City: Mt Vernon State: VA Birthday 1732-02-23
ID: 101 First: John Last: Adams
EMail: jadams@example.com
City: Braintree State: MA Birthday 1735-10-30
ID: 102 First: Thomas Last: Jefferson
EMail: tjeff@example.com
City: CharlottesVille State: VA Birthday 1743-04-13
ID: 103 First: James Last: Madison
EMail: jmad@example.com
City: Orange State: VA Birthday 1751-03-16
ID: 104 First: James Last: Monroe
EMail: jmo@example.com
City: New York State: NY Birthday 1758-04-28
```

Chrome Window with http://localhost:8080/myapp/customers/all URL (files/Curl-Customer-All.txt)

Notice the list of all the customers in the list are returned as plain text.

2. Enter this address in the address bar: `http://localhost:8080/myapp/customers/101`

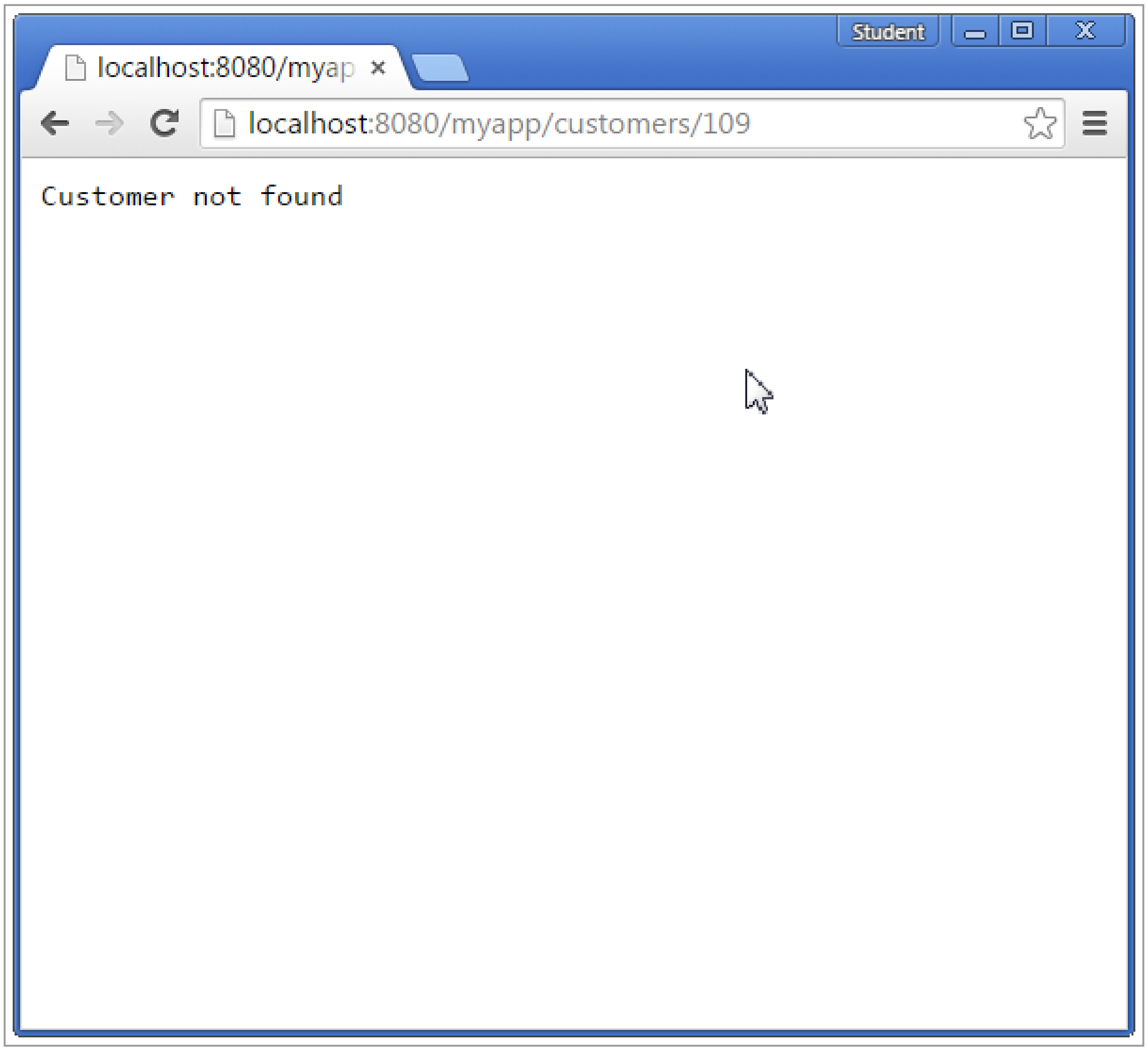


```
---Customer---
ID: 101 First: John Last: Adams
EMail: jadams@example.com
City: Braintree State: MA Birthday 1735-10-30
```

Chrome Window with http://localhost:8080/myapp/customers/101 URL (files/Curl-Customer-101.txt)

Notice the customer with an ID of 101 is returned as plain text.

3. Enter this address in the address bar: `http://localhost:8080/myapp/customers/109`



```
Customer not found
```

Chrome Window with http://localhost:8080/myapp/customers/109 URL (files/Curl-Customer-109.txt)

Notice an error message is returned since no match can be found.

Testing with `curl`

Using the curl network utility is a great way to test REST web services. `curl` is installed by default on most Unix and Linux distributions. On Windows, the best way to use `curl` is to install Cygwin (https://www.cygwin.com/) and make sure to select `curl` during the installation. You can also install `curl` standalone from this web site (http://curl.haxx.se/).

The tests from the previous example can be perform with `curl` as follows.

1. To get all customers type: `curl -X GET -i http://localhost:8080/myapp/customers/all`

```
HTTP/1.1 200 OK
Content-Type: text/plain
Date: Tue, 05 May 2015 21:40:18 GMT
Content-Length: 552

---Customer List---
ID: 100 First: George Last: Washington
EMail: gwash@example.com
City: Mt Vernon State: VA Birthday 1732-02-23
ID: 101 First: John Last: Adams
EMail: jadams@example.com
City: Braintree State: MA Birthday 1735-10-30
ID: 102 First: Thomas Last: Jefferson
EMail: tjeff@example.com
City: CharlottesVille State: VA Birthday 1743-04-13
ID: 103 First: James Last: Madison
EMail: jmad@example.com
City: Orange State: VA Birthday 1751-03-16
ID: 104 First: James Last: Monroe
EMail: jmo@example.com
City: New York State: NY Birthday 1758-04-28
```

Each customer in the list is displayed.

2. To get customer 101 type: `curl -X GET -i http://localhost:8080/myapp/customers/101`

```
HTTP/1.1 200 OK
Content-Type: text/plain
Date: Tue, 05 May 2015 21:41:43 GMT
Content-Length: 118

---Customer---
ID: 101 First: John Last: Adams
EMail: jadams@example.com
City: Braintree State: MA Birthday 1735-10-30
```

Customer 101 is found and returned.

3. To attempt to get customer 109 type: `curl -X GET -i http://localhost:8080/myapp/customers/109`

```
HTTP/1.1 200 OK
Content-Type: text/plain
Date: Tue, 05 May 2015 21:42:10 GMT
Content-Length: 18

Customer not found
```

An error message is returned.

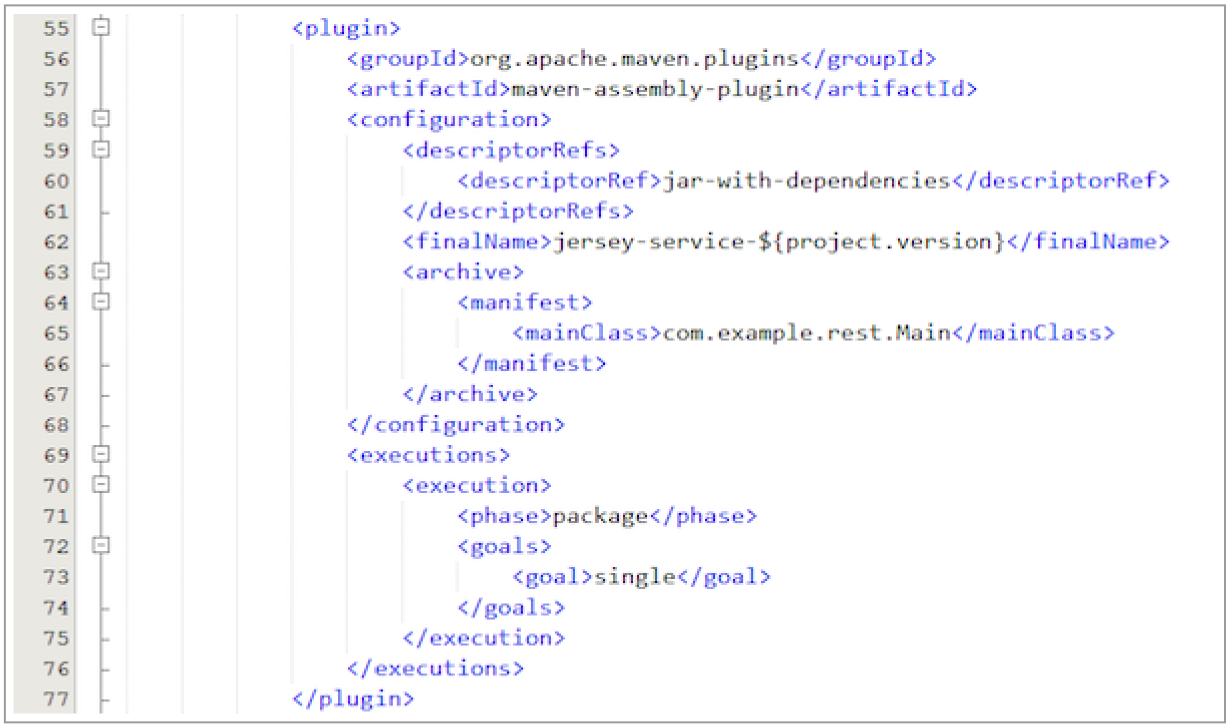
Creating an Uber JAR

The last topic to discuss is the concept of an uber JAR. If you use the default Maven settings to create a JAR, only the class files generated from source file are included in the JAR. This works fine when executing an application from Maven since any dependencies are downloaded into the local Maven cache. However, this does not produce a stand alone application file that can be run anywhere. The Grizzly and Jersey libraries must be included in your `CLASSPATH` variable for your application to run. When there are a lot of libraries included in your application, the `CLASSPATH` can get rather messy. Is there an easier way?

An uber JAR is a JAR file where all the dependencies required to run the application are included in a single jar. This way, your entire application can be distributed in a single file without messy `CLASSPATH` variables or extra software installations. To do this, changes must be made to the `pom.xml` file.

Updating the `pom.xml` File

The first change to the file is the addition of the assembly plugin. Here is the XML for this plugin.

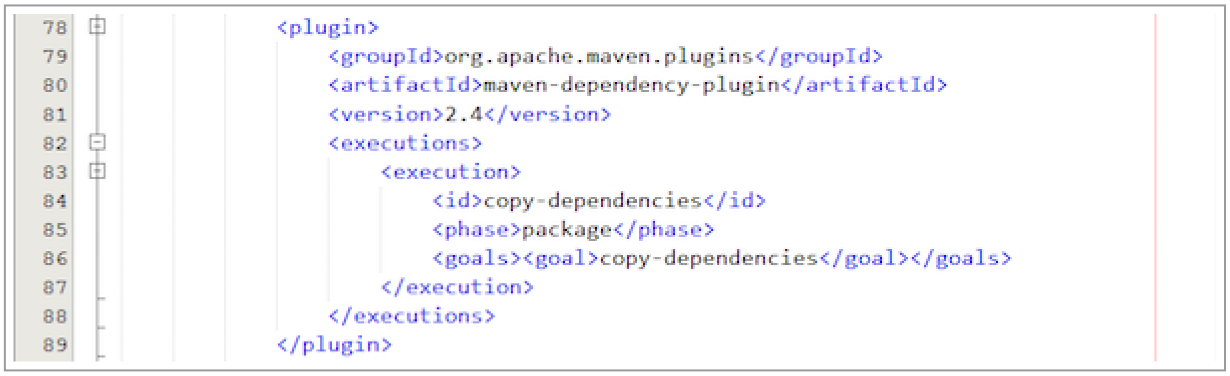


```
            <plugin>
                <groupId>org.apache.maven.plugins</groupId>
                <artifactId>maven-assembly-plugin</artifactId>
                <configuration>
                    <descriptorRefs>
                        <descriptorRef>jar-with-dependencies</descriptorRef>
                    </descriptorRefs>
                    <finalName>jersey-service-${project.version}</finalName>
                    <archive>
                        <manifest>
                            <mainClass>com.example.rest.Main</mainClass>
                        </manifest>
                    </archive>
                </configuration>
                <executions>
                    <execution>
                        <phase>package</phase>
                        <goals>
                            <goal>single</goal>
                        </goals>
                    </execution>
                </executions>
            </plugin>
```

Maven Assembly Plugin XML (files/pom-uber.xml.txt)

The assembly plugin is typically used to create JAR or WAR files that package Java applications into a file. Notice that the `Main` class is set so that an executable JAR is created. Doing this allows the JAR file to execute using the `java -jar` command line option. Also note that the `FinalName` value has been updated to match the rest of the project.

So now we have created an executable JAR. How are the required libraries for the application added to the jar? The dependency plugin is required to do that.



```
            <plugin>
                <groupId>org.apache.maven.plugins</groupId>
                <artifactId>maven-dependency-plugin</artifactId>
                <version>2.4</version>
                <executions>
                    <execution>
                        <id>copy-dependencies</id>
                        <phase>package</phase>
                        <goals><goal>copy-dependencies</goal></goals>
                    </execution>
                </executions>
            </plugin>
```

Maven Dependency Plugin XML (files/pom-uber.xml.txt)

By adding this plugin with the `copy-dependencies` goal, required libraries are copied into the JAR. Thus, all the required class files to run the application are included in the JAR. No external `CLASSPATH` or other settings are required to execute the application.

Executing the Application

To build and execute your application follow these steps.

1. Change into the project directory.
2. Clean and compile the application: `mvn clean compile`
3. Package the application: `mvn package`
4. Look in the `target` directory. You should see a file with the following or a similar name: `jersey-service-1.0-SNAPSHOT-jar-with-dependencies.jar`
5. Change into the `target` directory.
6. Execute the jar: `java -jar jersey-service-1.0-SNAPSHOT-jar-with-dependencies.jar`

Your Grizzly/Jersey should now execute and start the service just like it did before from Maven. Since this JAR is self contained, it can be copied to a different location on the machine or to another machine and execute. The application is now completely self-contained.

Adding Flexibility to the Server

Before completing this OBE there is one improvement I would like to discuss. Wouldn't the application be better if it was more flexible at startup? For example, it would be really nice to set the network port or host name at runtime. Right now, the application can only do this when compiled. Maybe something like environment variables could be used for configuration? That sounds like a good approach.

But Mike, what if the environment variables aren't set? Won't that result in null values which require all sorts of checking with `if` blocks?

Well... It turns out that the new `Optional` class in Java 8 can make this sort of thing fairly easy.

What follows is a new version of the `Main` class which checks for the `PORT` and `HOSTNAME` environment variables at run time. If the values are set, they are used to launch the server, if they are not, default values are used instead.

`Main.java`

```
package com.example.rest;

import org.glassfish.grizzly.http.server.HttpServer;
import org.glassfish.jersey.grizzly2.httpserver.GrizzlyHttpServerFactory;
import org.glassfish.jersey.server.ResourceConfig;

import java.io.IOException;
import java.net.URI;
import java.util.Optional;

/**
 * Main class
 */
public class Main{

    // Base URI the Grizzly HTTP server will listen on
    public static final String BASE_URI;
    public static final String protocol;
    public static final Optional<String> host;
    public static final String path;
    public static final Optional<String> port;

    static{
      protocol = "http://";
      host = Optional.ofNullable(System.getenv("HOSTNAME"));
      port = Optional.ofNullable(System.getenv("PORT"));
      path = "myapp";
      BASE_URI = protocol + host.orElse("localhost") + ":" + port.orElse("8080") + "/" + path +
 "/";
    }

    /**
     * Starts Grizzly HTTP server exposing JAX-RS resources defined in this application.
     * @return Grizzly HTTP server.
     */
    public static HttpServer startServer() {
        // create a resource config that scans for JAX-RS resources and providers
        // in com.example.rest package
        final ResourceConfig rc = new ResourceConfig().packages("com.example.rest");

        // create and start a new instance of grizzly http server
        // exposing the Jersey application at BASE_URI
        return GrizzlyHttpServerFactory.createHttpServer(URI.create(BASE_URI), rc);
    }

    /**
     * Main method.
     * @param args
     * @throws IOException
     */
    public static void main(String[] args) throws IOException {
        final HttpServer server = startServer();
        System.out.println(String.format("Jersey app started with WADL available at "
                + "%sapplication.wadl\nHit enter to stop it...", BASE_URI));
        System.in.read();
        server.stop();
    }
}
```

A couple of key points.

- At the top of the class notice two `Optional<String>` variables are declared. The `port` and `host` fields will store the result of our environment variable lookup.
- In the `static` initialization block, the `System.getenv` method is used to get the environment variable. Notice that the `Optional.ofNullable` method is called. This method will return either the value stored in the environment variable or an empty `Optional` if no value is returned.
- The `BASE_URI` field now uses the `Optional` variables to create the URI. The `orElse` method sets a default value if the optional is empty.

With these improvements, you can set the host name or port using environment variables. The additional code is clear and concise.

That concludes this tutorial.

Download Suggested Solution

If you want to see the complete set of project files, download the source files and Maven project from the following link:

- jersey-service.zip (files/jersey-service.zip)

Want to Learn More?

If you want to learn more, here are some related links.

- Apache Maven Assembly Plugin (http://maven.apache.org/plugins/maven-assembly-plugin/)
- Apache Maven Dependency Plugin (https://maven.apache.org/plugins/maven-dependency-plugin/)
- Jersey and JAX-RS (https://jersey.java.net/)
- Project Grizzly (https://grizzly.java.net/)
- REST Architectural Style (http://en.wikipedia.org/wiki/Representational_state_transfer)

Credits

- Curriculum Developer: Michael Williams
- QA: Sravanti Tatiraju