Spring Restful Web Service Example with JSON, Jackson and Client Program

Spring is one of the most widely used Java EE framework. We have earlier seen how to use Spring MVC to create Java based web applications. Today we will use Spring MVC to create Restful web application and then test it out with the Rest client. At the end, we will also look into how to invoke Spring Restful web service using **Spring RestTemplate API**.

We will use Spring latest version **4.0.0.RELEASE** and utilize Spring Jackson JSON API integration to send JSON response in the rest call response. The tutorial is developed in Spring STS IDE for creating Spring MVC skeleton code easily and then extended to implement Restful architecture.

Create a new Spring MVC Project in the STS, our final project will look like below image. We will look into each of the components one by one.

Configuration XML Files

Our pom.xml file looks like below.

pom.xml

```xml
<?xml version="1.0" encoding="UTF-8"?>
<project xmlns="http://maven.apache.org/POM/4.0.0" xmlns:xsi="http://www.w3.
    xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 http://maven.apach
    <modelVersion>4.0.0</modelVersion>
    <groupId>com.journaldev</groupId>
    <artifactId>SpringRestExample</artifactId>
    <name>SpringRestExample</name>
    <packaging>war</packaging>
    <version>1.0.0-BUILD-SNAPSHOT</version>
    <properties>
        <java-version>1.6</java-version>
        <org.springframework-version>4.0.0.RELEASE</org.springframework-vers
        <org.aspectj-version>1.7.4</org.aspectj-version>
        <org.slf4j-version>1.7.5</org.slf4j-version>
        <jackson.databind-version>2.2.3</jackson.databind-version>
    </properties>
    <dependencies>
        <!-- Jackson -->
        <dependency>
            <groupId>com.fasterxml.jackson.core</groupId>
            <artifactId>jackson-databind</artifactId>
            <version>${jackson.databind-version}</version>
        </dependency>
        <!-- Spring -->
        <dependency>
            <groupId>org.springframework</groupId>
            <artifactId>spring-context</artifactId>
            <version>${org.springframework-version}</version>
            <exclusions>
                <!-- Exclude Commons Logging in favor of SLF4j -->
                <exclusion>
                    <groupId>commons-logging</groupId>
                    <artifactId>commons-logging</artifactId>
                </exclusion>
            </exclusions>
        </dependency>
        <dependency>
            <groupId>org.springframework</groupId>
            <artifactId>spring-webmvc</artifactId>
            <version>${org.springframework-version}</version>
        </dependency>

        <!-- AspectJ -->
        <dependency>
            <groupId>org.aspectj</groupId>
            <artifactId>aspectjrt</artifactId>
            <version>${org.aspectj-version}</version>
        </dependency>

        <!-- Logging -->
        <dependency>
            <groupId>org.slf4j</groupId>
            <artifactId>slf4j-api</artifactId>
            <version>${org.slf4j-version}</version>
        </dependency>
        <dependency>
            <groupId>org.slf4j</groupId>
            <artifactId>jcl-over-slf4j</artifactId>
            <version>${org.slf4j-version}</version>
            <scope>runtime</scope>
        </dependency>
        <dependency>
            <groupId>org.slf4j</groupId>
            <artifactId>slf4j-log4j12</artifactId>
```

```
            <version>${org.slf4j-version}</version>
            <scope>runtime</scope>
        </dependency>
        <dependency>
            <groupId>log4j</groupId>
            <artifactId>log4j</artifactId>
            <version>1.2.15</version>
            <exclusions>
                <exclusion>
                    <groupId>javax.mail</groupId>
                    <artifactId>mail</artifactId>
                </exclusion>
                <exclusion>
                    <groupId>javax.jms</groupId>
                    <artifactId>jms</artifactId>
                </exclusion>
                <exclusion>
                    <groupId>com.sun.jdmk</groupId>
                    <artifactId>jmxtools</artifactId>
                </exclusion>
                <exclusion>
                    <groupId>com.sun.jmx</groupId>
                    <artifactId>jmxri</artifactId>
                </exclusion>
            </exclusions>
            <scope>runtime</scope>
        </dependency>

        <!-- @Inject -->
        <dependency>
            <groupId>javax.inject</groupId>
            <artifactId>javax.inject</artifactId>
            <version>1</version>
        </dependency>

        <!-- Servlet -->
        <dependency>
            <groupId>javax.servlet</groupId>
            <artifactId>servlet-api</artifactId>
            <version>2.5</version>
            <scope>provided</scope>
        </dependency>
        <dependency>
            <groupId>javax.servlet.jsp</groupId>
            <artifactId>jsp-api</artifactId>
            <version>2.1</version>
            <scope>provided</scope>
        </dependency>
        <dependency>
            <groupId>javax.servlet</groupId>
            <artifactId>jstl</artifactId>
            <version>1.2</version>
        </dependency>

        <!-- Test -->
        <dependency>
            <groupId>junit</groupId>
            <artifactId>junit</artifactId>
            <version>4.7</version>
            <scope>test</scope>
        </dependency>
    </dependencies>
    <build>
        <plugins>
            <plugin>
```

```
                <artifactId>maven-eclipse-plugin</artifactId>
                <version>2.9</version>
                <configuration>
                    <additionalProjectnatures>
                        <projectnature>org.springframework.ide.eclipse.core.
                    </additionalProjectnatures>
                    <additionalBuildcommands>
                        <buildcommand>org.springframework.ide.eclipse.core.sp
                    </additionalBuildcommands>
                    <downloadSources>true</downloadSources>
                    <downloadJavadocs>true</downloadJavadocs>
                </configuration>
            </plugin>
            <plugin>
                <groupId>org.apache.maven.plugins</groupId>
                <artifactId>maven-compiler-plugin</artifactId>
                <version>2.5.1</version>
                <configuration>
                    <source>1.6</source>
                    <target>1.6</target>
                    <compilerArgument>-Xlint:all</compilerArgument>
                    <showWarnings>true</showWarnings>
                    <showDeprecation>true</showDeprecation>
                </configuration>
            </plugin>
            <plugin>
                <groupId>org.codehaus.mojo</groupId>
                <artifactId>exec-maven-plugin</artifactId>
                <version>1.2.1</version>
                <configuration>
                    <mainClass>org.test.int1.Main</mainClass>
                </configuration>
            </plugin>
        </plugins>

    </build>
</project>
```

STS tool generates the pom.xml file for us, however I have updated the Spring Framework, AspectJ, SLF4J and Jackson version to the latest one as of today. Most of the part is common and generated automatically, the important point to note is that I have added Jackson JSON libraries in the dependency because we will use that to convert Objects to JSON and vice versa.

web.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<web-app version="2.5" xmlns="http://java.sun.com/xml/ns/javaee"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://java.sun.com/xml/ns/javaee http://java.sun.com/

    <!-- The definition of the Root Spring Container shared by all Servlets an
    <context-param>
        <param-name>contextConfigLocation</param-name>
        <param-value>/WEB-INF/spring/root-context.xml</param-value>
    </context-param>

    <!-- Creates the Spring Container shared by all Servlets and Filters -->
    <listener>
        <listener-class>org.springframework.web.context.ContextLoaderListener
    </listener>

    <!-- Processes application requests -->
```

```
    <servlet>
        <servlet-name>appServlet</servlet-name>
        <servlet-class>org.springframework.web.servlet.DispatcherServlet</serv
        <init-param>
            <param-name>contextConfigLocation</param-name>
            <param-value>/WEB-INF/spring/appServlet/servlet-context.xml</paran
        </init-param>
        <load-on-startup>1</load-on-startup>
    </servlet>

    <servlet-mapping>
        <servlet-name>appServlet</servlet-name>
        <url-pattern>/</url-pattern>
    </servlet-mapping>

</web-app>
```

This file is generated automatically and I haven't changed anything in that. However if you want to change context configuration files and their location, you can do it in the web.xml file.

root-context.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://www.springframework.org/schema/beans http://www

    <!-- Root Context: defines shared resources visible to all other web compor

</beans>
```

This file contains the shared resources that will be visible to all the web components, we will be developing a simple rest service and that's why I haven't changed anything here.

servlet-context.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<beans:beans xmlns="http://www.springframework.org/schema/mvc"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:beans="http://www.springframework.org/schema/beans"
    xmlns:context="http://www.springframework.org/schema/context"
    xsi:schemaLocation="http://www.springframework.org/schema/mvc http://www.s
        http://www.springframework.org/schema/beans http://www.springframeworl
        http://www.springframework.org/schema/context http://www.springframewo

    <!-- DispatcherServlet Context: defines this servlet's request-processing

    <!-- Enables the Spring MVC @Controller programming model -->
    <annotation-driven />

    <!-- Handles HTTP GET requests for /resources/** by efficiently serving up
    <resources mapping="/resources/**" location="/resources/" />

    <!-- Resolves views selected for rendering by @Controllers to .jsp resourc
    <beans:bean class="org.springframework.web.servlet.view.InternalResourceVi
        <beans:property name="prefix" value="/WEB-INF/views/" />
        <beans:property name="suffix" value=".jsp" />
    </beans:bean>

    <!-- Configure to plugin JSON as request and response in method handler --
```

```
    <beans:bean class="org.springframework.web.servlet.mvc.method.annotation.
        <beans:property name="messageConverters">
            <beans:list>
                <beans:ref bean="jsonMessageConverter"/>
            </beans:list>
        </beans:property>
    </beans:bean>

    <!-- Configure bean to convert JSON to POJO and vice versa -->
    <beans:bean id="jsonMessageConverter" class="org.springframework.http.conv
    </beans:bean>

    <context:component-scan base-package="com.journaldev.spring.controller" />

</beans:beans>
```

Most of the part is auto generated and contains boiler-plate configurations. However important points to note are **annotation-driven** element to support annotations based configuration and plugging in `MappingJackson2HttpMessageConverter` to the `RequestMappingHandlerAdapter` `messageConverters` so that Jackson API kicks in and converts JSON to Java Beans and vice versa. By having this configuration, we will be using JSON in request body and we will receive JSON data in the response.

Model Class

Let's write a simple POJO class that will serve as input and output to our Restful web service methods.

Employee.java

```
package com.journaldev.spring.model;

import java.io.Serializable;
import java.util.Date;

import com.fasterxml.jackson.databind.annotation.JsonSerialize;
import com.fasterxml.jackson.databind.ser.std.DateSerializer;

public class Employee implements Serializable{

    private static final long serialVersionUID = -7788619177798333712L;

    private int id;
    private String name;
    private Date createdDate;

    public int getId() {
        return id;
    }
    public void setId(int id) {
        this.id = id;
    }
    public String getName() {
        return name;
    }
    public void setName(String name) {
        this.name = name;
    }

```

```
    @JsonSerialize(using=DateSerializer.class)
    public Date getCreatedDate() {
        return createdDate;
    }
    public void setCreatedDate(Date createdDate) {
        this.createdDate = createdDate;
    }


}
```

The only important point to note is the use of `@JsonSerialize` annotation to use `DateSerializer` class for Date conversion from Java type to JSON format and vice versa.

Spring Restful web service End Points

We will have following rest web services end points.

Sl. No	URI	HTTP Method	Details
1	/rest/emp/dummy	GET	Health Check service, to insert a dummy data in the Employees data storage
2	/rest/emp/{id}	GET	To get the Employee object based on the id
3	/rest/emps	GET	To get the list of all the Employees in the data store
4	/rest/emp/create	POST	To create the Employee object and store it
5	/rest/emp/delete/{id}	PUT	To delete the Employee object from the data storage based on the id

We have a class defining all these URI as String constants.

EmpRestURIConstants.java

```
package com.journaldev.spring.controller;

public class EmpRestURIConstants {

    public static final String DUMMY_EMP = "/rest/emp/dummy";
    public static final String GET_EMP = "/rest/emp/{id}";
    public static final String GET_ALL_EMP = "/rest/emps";
    public static final String CREATE_EMP = "/rest/emp/create";
    public static final String DELETE_EMP = "/rest/emp/delete/{id}";
}
```

Spring Restful web service Controller class

Our EmployeeController class will publish all the web service end points mentioned above, let's look at the code of the class and then we will learn about each of the methods in detail.

EmployeeController.java

```
package com.journaldev.spring.controller;

import java.util.ArrayList;
import java.util.Date;
import java.util.HashMap;
import java.util.List;
import java.util.Map;
import java.util.Set;

import org.slf4j.Logger;
import org.slf4j.LoggerFactory;
import org.springframework.stereotype.Controller;
import org.springframework.web.bind.annotation.PathVariable;
import org.springframework.web.bind.annotation.RequestBody;
import org.springframework.web.bind.annotation.RequestMapping;
import org.springframework.web.bind.annotation.RequestMethod;
import org.springframework.web.bind.annotation.ResponseBody;

import com.journaldev.spring.model.Employee;

/**
 * Handles requests for the Employee service.
 */
@Controller
public class EmployeeController {

    private static final Logger logger = LoggerFactory.getLogger(EmployeeContr

    //Map to store employees, ideally we should use database
    Map<Integer, Employee> empData = new HashMap<Integer, Employee>();

    @RequestMapping(value = EmpRestURIConstants.DUMMY_EMP, method = RequestMet
    public @ResponseBody Employee getDummyEmployee() {
        logger.info("Start getDummyEmployee");
        Employee emp = new Employee();
        emp.setId(9999);
        emp.setName("Dummy");
        emp.setCreatedDate(new Date());
        empData.put(9999, emp);
        return emp;
    }

    @RequestMapping(value = EmpRestURIConstants.GET_EMP, method = RequestMetho
    public @ResponseBody Employee getEmployee(@PathVariable("id") int empId) {
        logger.info("Start getEmployee. ID="+empId);

        return empData.get(empId);
    }

    @RequestMapping(value = EmpRestURIConstants.GET_ALL_EMP, method = RequestM
    public @ResponseBody List<Employee> getAllEmployees() {
        logger.info("Start getAllEmployees.");
        List<Employee> emps = new ArrayList<Employee>();
        Set<Integer> empIdKeys = empData.keySet();
        for(Integer i : empIdKeys){
            emps.add(empData.get(i));
        }
        return emps;
```

```
59          }
60
61          @RequestMapping(value = EmpRestURIConstants.CREATE_EMP, method = RequestMe
62          public @ResponseBody Employee createEmployee(@RequestBody Employee emp) {
63              logger.info("Start createEmployee.");
64              emp.setCreatedDate(new Date());
65              empData.put(emp.getId(), emp);
66              return emp;
67          }
68
69          @RequestMapping(value = EmpRestURIConstants.DELETE_EMP, method = RequestMe
70          public @ResponseBody Employee deleteEmployee(@PathVariable("id") int empId
71              logger.info("Start deleteEmployee.");
72              Employee emp = empData.get(empId);
73              empData.remove(empId);
74              return emp;
75          }
76
77      }
```

For simplicity, I am storing all the employees data in the HashMap empData. @RequestMapping annotation is used to map the request URI to the handler method. We can also specify the HTTP method that should be used by client application to invoke the rest method.

@ResponseBody annotation is used to map the response object in the response body. Once the response object is returned by the handler method, MappingJackson2HttpMessageConverter kicks in and convert it to JSON response.

@PathVariable annotation is the easy way to extract the data from the rest URI and map it to the method argument.

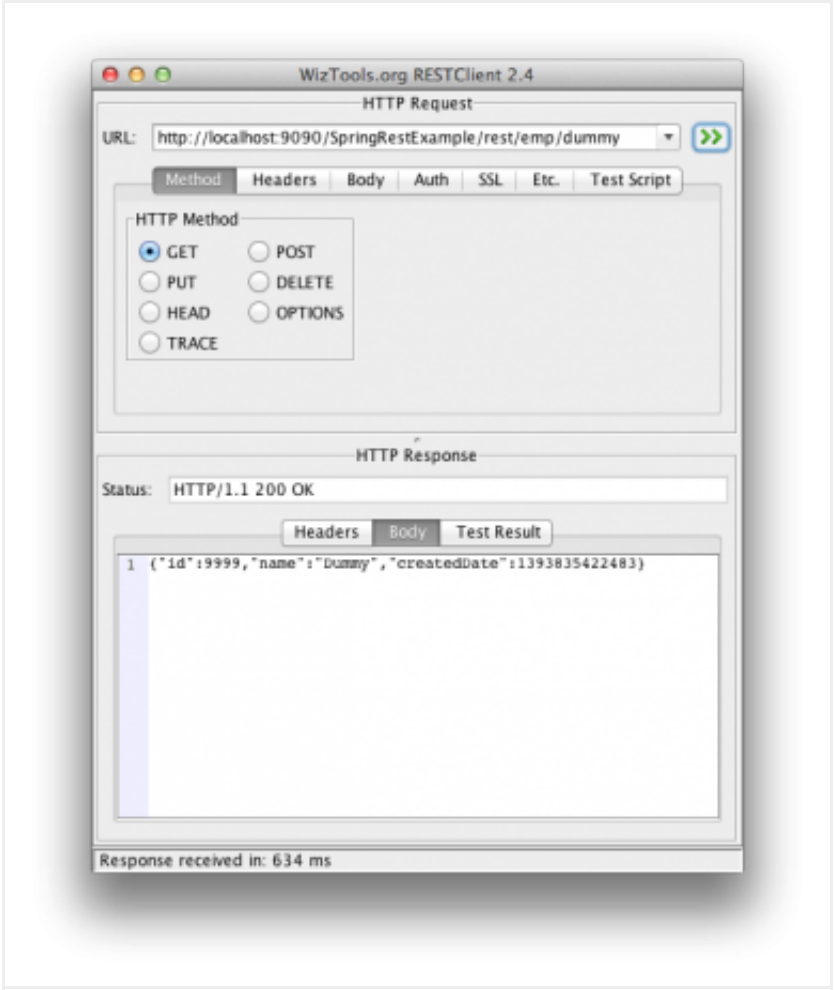
@RequestBody annotation is used to map the request body JSON data into the Employee object, again this is done by the MappingJackson2HttpMessageConverter mapping.

Rest of the code is simple and self understood, our application is ready for deployment and testing. Just export as WAR file and copy it in the servlet container web app directory. If you have server configured in the STS, you can simply run it on the server to get it deployed.

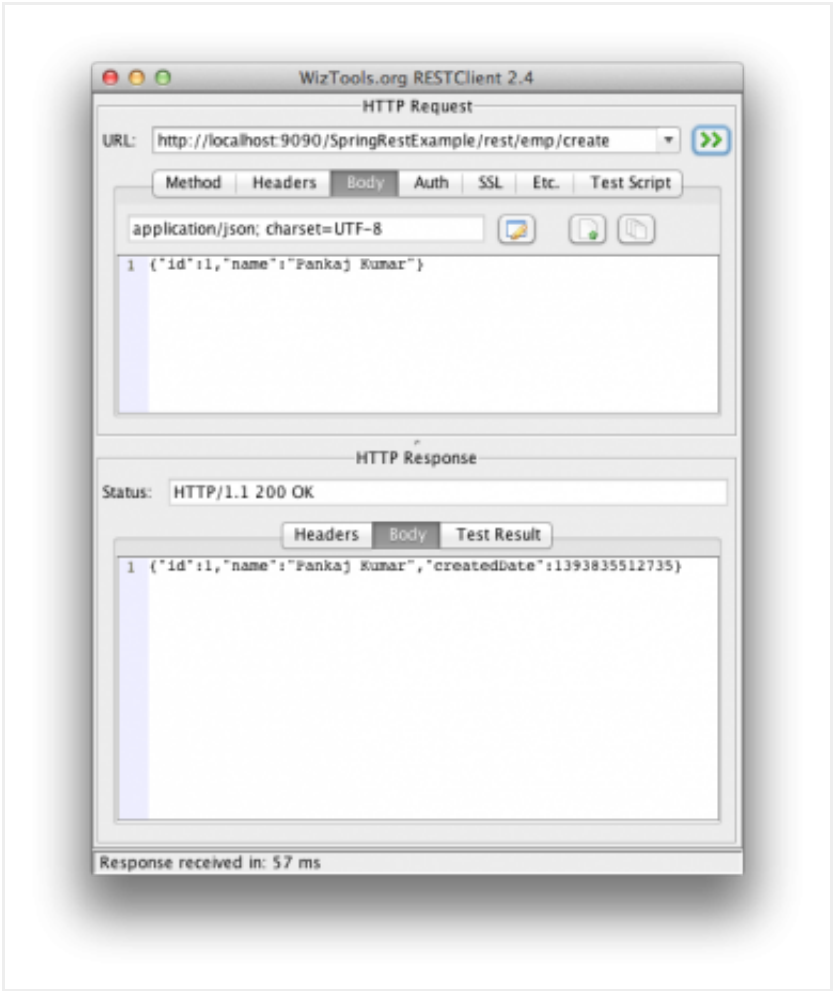
I am using WizTools RestClient to invoke the rest calls but you can also use Chrome extension Postman.

Below screenshots shows the different invocations of the rest apis exposed by our application and it's output.

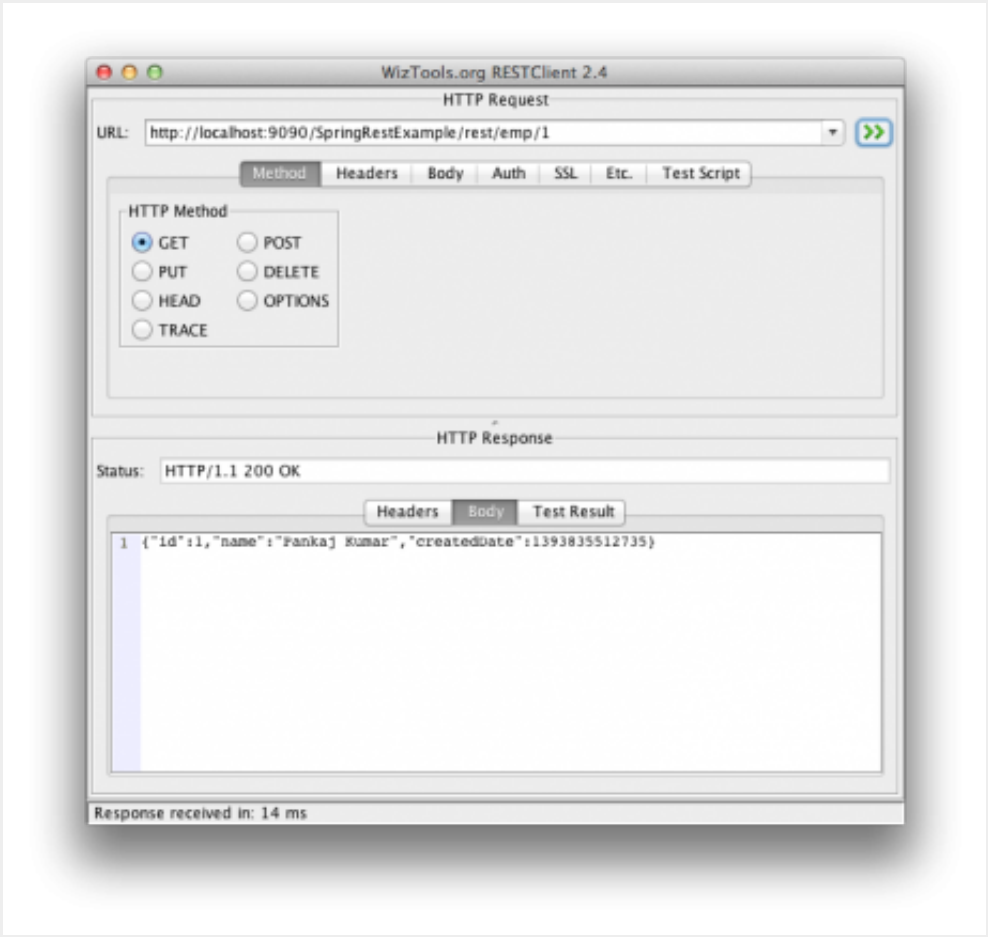
Health Check – Get Dummy Employee Rest Call



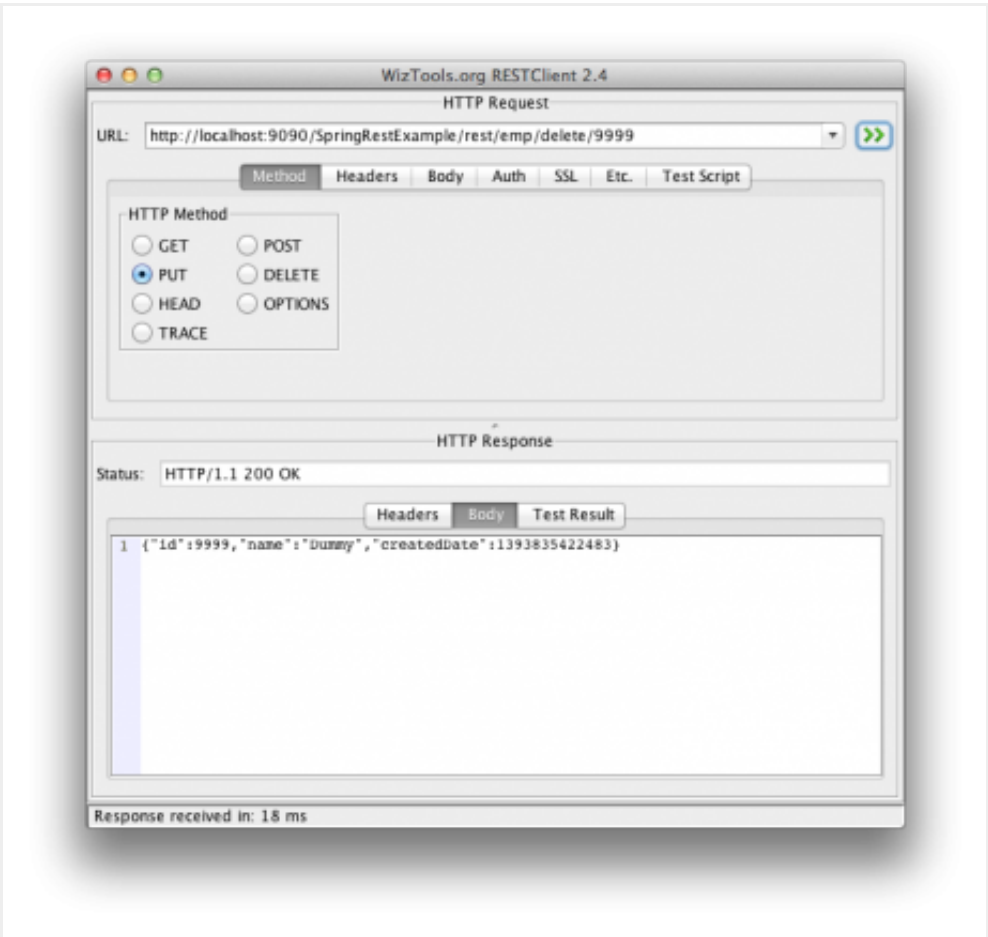
Create Employee POST Rest Call: Make sure request Content-Type is set to “application/json” otherwise you will get HTTP Error Code 415.



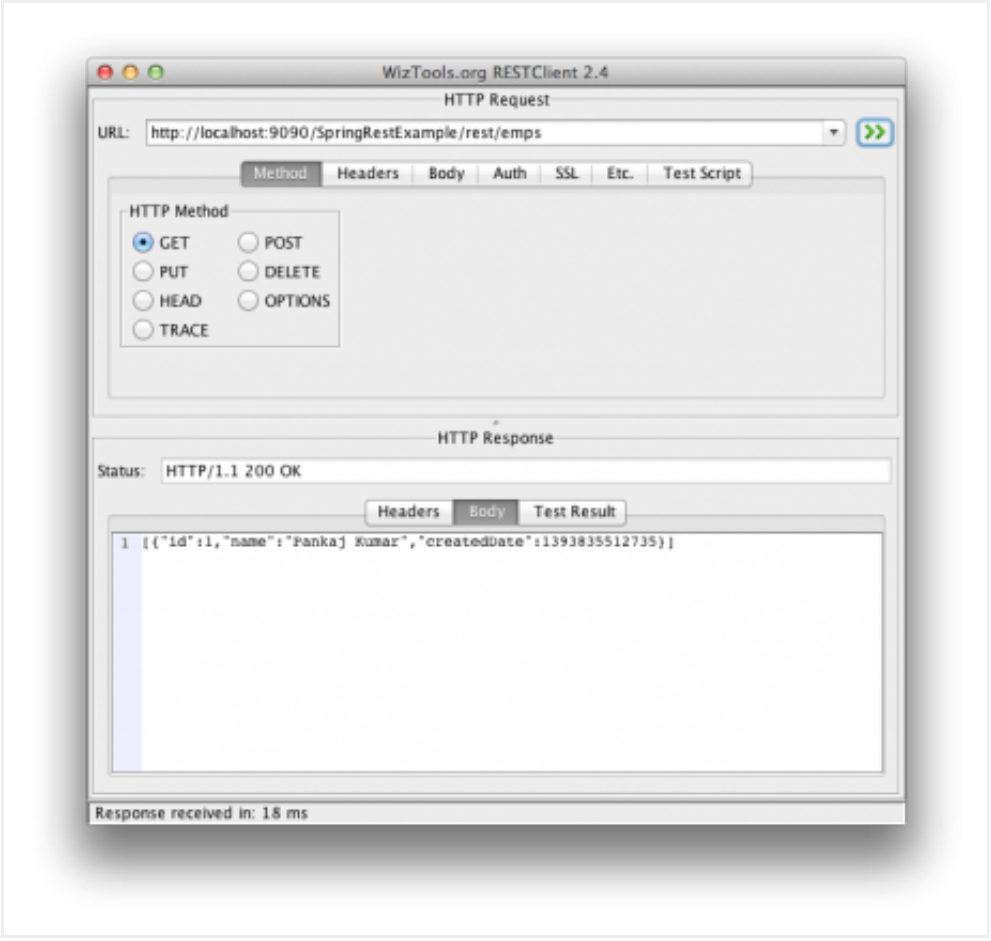
Get Employee Rest Call



Delete Employee Rest Call



Get All Employees Rest Call



Spring Rest Client Program

Rest Clients are good to test our rest web service but most of the times, we need to invoke rest services through our program. We can use Spring `RestTemplate` to invoke these methods easily. Below is a simple program invoking our application rest methods using RestTemplate API.

TestSpringRestExample.java

```
1  package com.journaldev.spring;
2
3  import java.util.LinkedHashMap;
4  import java.util.List;
5
6  import org.springframework.web.client.RestTemplate;
7
8  import com.journaldev.spring.controller.EmpRestURIConstants;
9  import com.journaldev.spring.model.Employee;
10
11 public class TestSpringRestExample {
12
13     public static final String SERVER_URI = "http://localhost:9090/SpringRestI
14
15     public static void main(String args[]){
16
17         testGetDummyEmployee();
18         System.out.println("*****");
19         testCreateEmployee();
20         System.out.println("*****");
21         testGetEmployee();
22         System.out.println("*****");
23         testGetAllEmployee();
24     }
```

```
    private static void testGetAllEmployee() {
        RestTemplate restTemplate = new RestTemplate();
        //we can't get List<Employee> because JSON convertor doesn't know the
        //object in the list and hence convert it to default JSON object type
        List<LinkedHashMap> emps = restTemplate.getForObject(SERVER_URI+EmpRes
        System.out.println(emps.size());
        for(LinkedHashMap map : emps){
            System.out.println("ID="+map.get("id")+",Name="+map.get("name")+"
        }
    }

    private static void testCreateEmployee() {
        RestTemplate restTemplate = new RestTemplate();
        Employee emp = new Employee();
        emp.setId(1);emp.setName("Pankaj Kumar");
        Employee response = restTemplate.postForObject(SERVER_URI+EmpRestURIC
        printEmpData(response);
    }

    private static void testGetEmployee() {
        RestTemplate restTemplate = new RestTemplate();
        Employee emp = restTemplate.getForObject(SERVER_URI+"/rest/emp/1", Emp
        printEmpData(emp);
    }

    private static void testGetDummyEmployee() {
        RestTemplate restTemplate = new RestTemplate();
        Employee emp = restTemplate.getForObject(SERVER_URI+EmpRestURIConstant
        printEmpData(emp);
    }

    public static void printEmpData(Employee emp){
        System.out.println("ID="+emp.getId()+",Name="+emp.getName()+",CreatedD
    }
}
```

Most of the program is simple to understand, however when invoking rest method returning a Collection, we need to use `LinkedHashMap` because JSON to object conversion doesn't know about the Employee object and converts it to the collection of `LinkedHashMap`. We can write a utility method to convert from `LinkedHashMap` to our Java Bean object.

When we run above program, we get following output in the console.

```
ID=9999,Name=Dummy,CreatedDate=Tue Mar 04 21:02:41 PST 2014
*****
ID=1,Name=Pankaj Kumar,CreatedDate=Tue Mar 04 21:02:41 PST 2014
*****
ID=1,Name=Pankaj Kumar,CreatedDate=Tue Mar 04 21:02:41 PST 2014
*****
2
ID=1,Name=Pankaj Kumar,CreatedDate=1393995761654
ID=9999,Name=Dummy,CreatedDate=1393995761381
```

Another point is that `RestTemplate` put methods doesn't have option to set response object because PUT method should be used to store something on the server and a simple HTTP 200 status code should be sufficient.

Download Spring Restful Webservice Project
5288 downloads

Thats all for the Spring Restful web application tutorial. Download the sample project from above link and play around with it to learn more.