Exercise 3

Create an embedded Java REST Service using JAX-RS and Spring Boot

Prior Knowledge
Basic understanding HTTP verbs, REST architecture
Some Java coding skill

Objectives
Understand what it takes to create REST services. Interact with a REST service using simple web clients in Chrome, on the command line.
See how Gradle can be used.

Software Requirements
(see separate document for installation of these)

- Java Development Kit 8
- Gradle build system
- Spring Boot and Jersey
- Visual Studio Code, including extensions:
    - Java
    - Spring Boot
    - SpringInitializr
    - Gradle
- curl
- Google Chrome/Chromium plus Chrome Advanced REST extension

Overview
There are many technologies for creating RESTful Web Services in Java. In order to create a simple approach, we are going to use the Java standard for creating REST services, which is called JAX-RS. The "official" Oracle implementation of JAX-RS is Jersey, although there are other implementations such as CXF and RESTEasy.

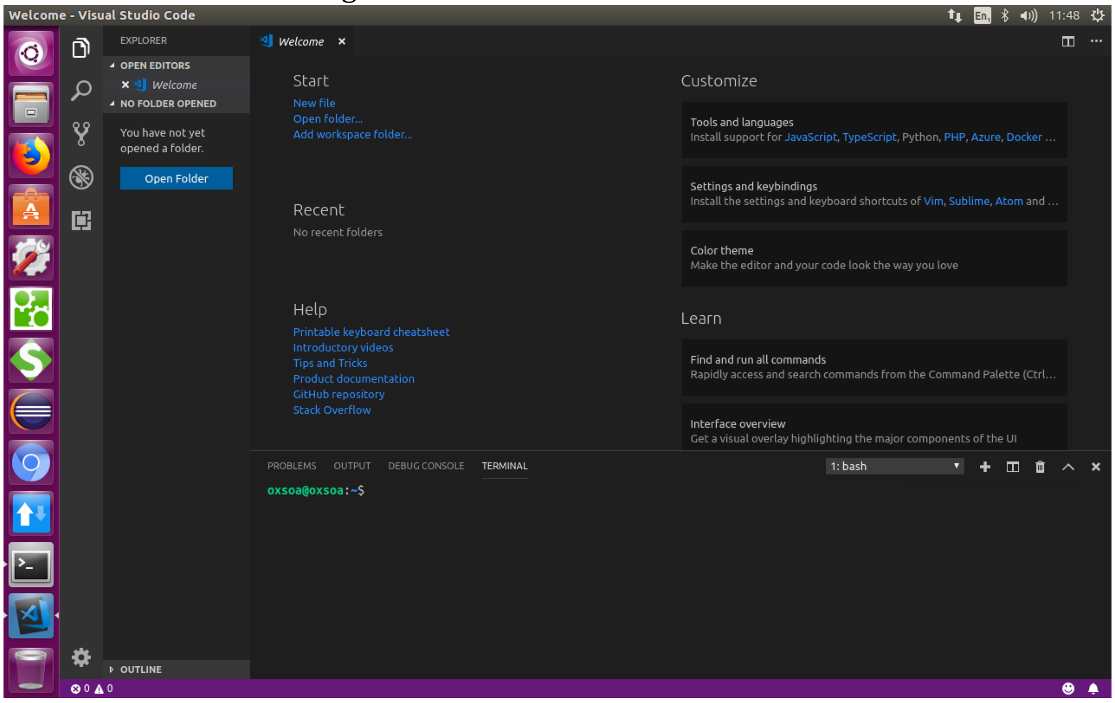
Spring Boot is a framework for running microservices.

Steps

1. Create a new directory:
```
mkdir ~/ex3
cd ~/ex3
```

2. Start Visual Studio Code:
```
code
```

   You should see something like:

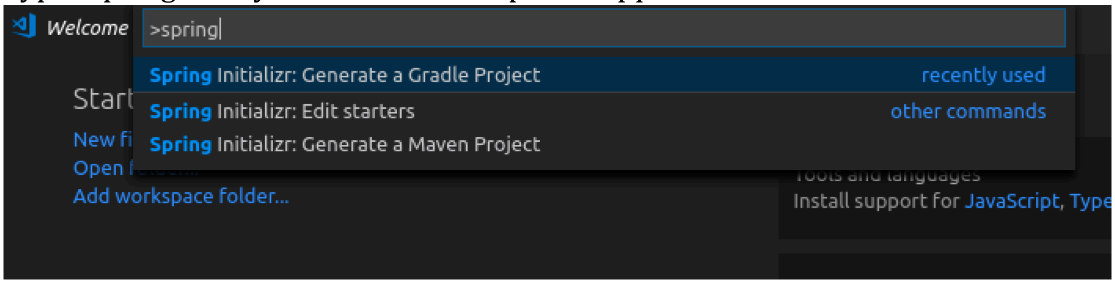


Welcome - Visual Studio Code

```
oxsoa@oxsoa:~$
```

3. Show the vscode "Command Palette" (Ctrl-Shift-P)

4. Type "spring" and you should some options appear:



```
>spring
Spring Initializr: Generate a Gradle Project      recently used
Spring Initializr: Edit starters                  other commands
Spring Initializr: Generate a Maven Project
```

5. Select **Spring Initalizr: Generate a Gradle Project**

6. Select **Java**

7. Type **me.freo** for the Group

8. Type **hello** for the artifact id

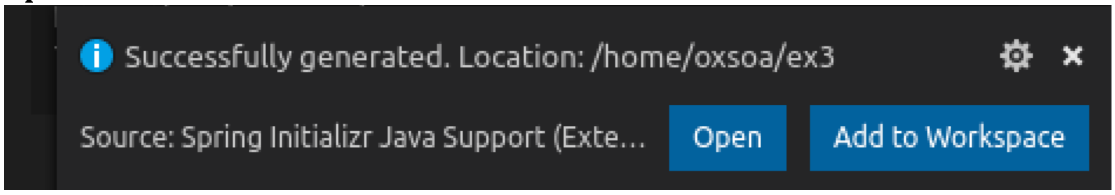
9. Choose **2.2.1** for the Spring Boot version

10. Type **Jersey** and then select **Jersey Web** for the dependency.

11. Then hit **Enter** to continue.

12. The window should be pointing to your ex3 directory and then click **Generate into this Folder.** If clicking doesn't work, try hitting **Enter**

13. You should see a notification that the code has been generated. Click **Open:**



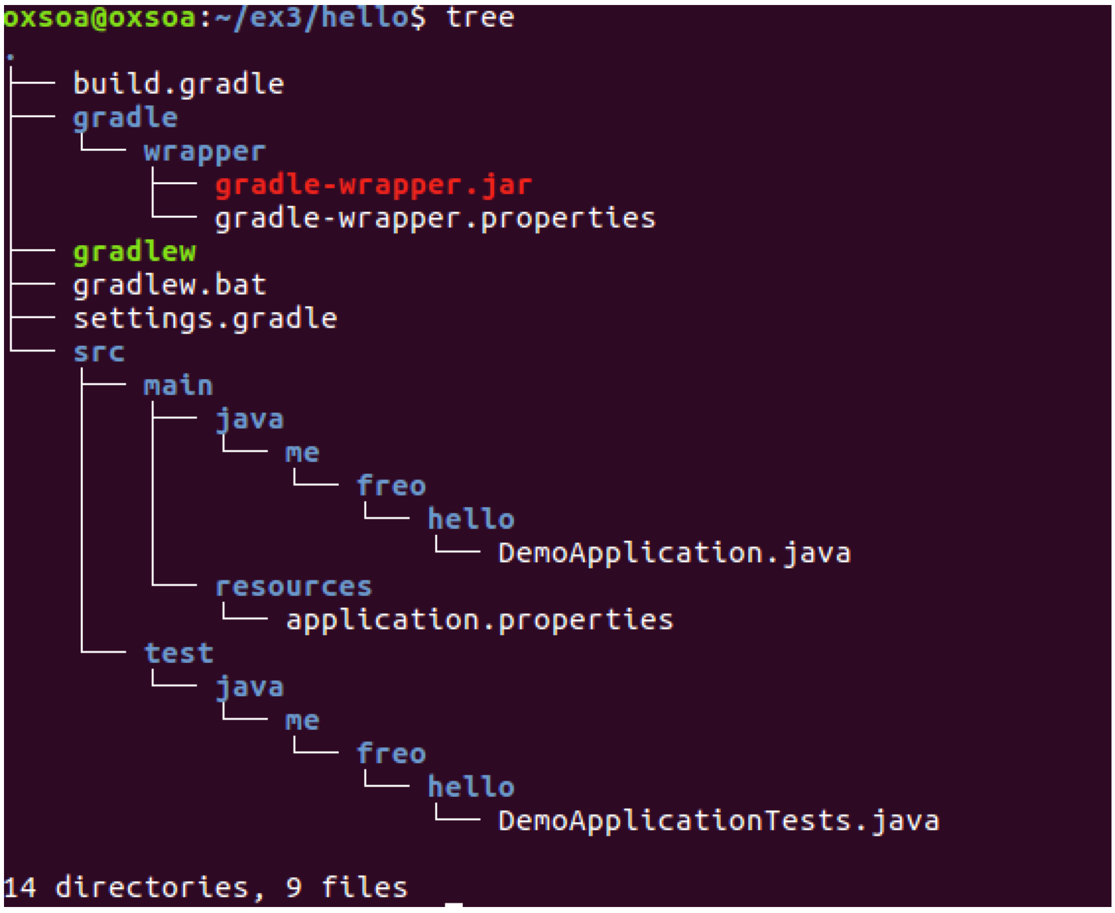
Successfully generated. Location: /home/oxsoa/ex3

Source: Spring Initializr Java Support (Exte...

14. On a command line:

```
cd ~/ex3/hello
tree
```

You should see:

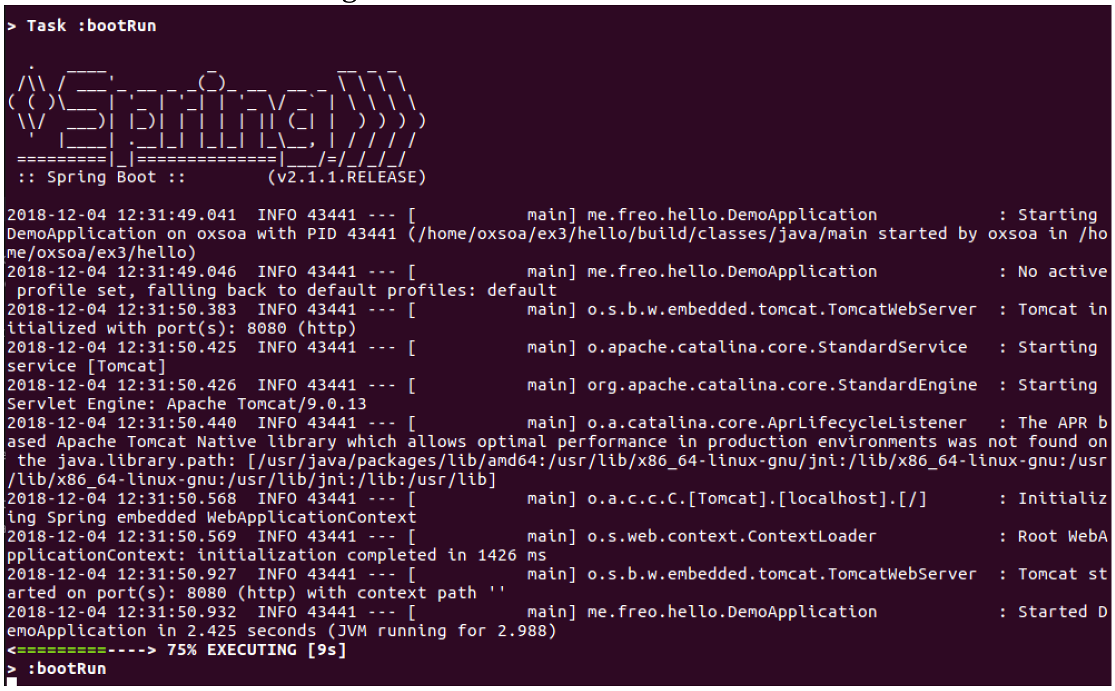


```
oxsoa@oxsoa:~/ex3/hello$ tree
.
├── build.gradle
├── gradle
│   └── wrapper
│       ├── gradle-wrapper.jar
│       └── gradle-wrapper.properties
├── gradlew
├── gradlew.bat
├── settings.gradle
└── src
    ├── main
    │   ├── java
    │   │   └── me
    │   │       └── freo
    │   │           └── hello
    │   │               └── DemoApplication.java
    │   └── resources
    │       └── application.properties
    └── test
        └── java
            └── me
                └── freo
                    └── hello
                        └── DemoApplicationTests.java

14 directories, 9 files
```

15. In the same place, type:
    `gradle build`

16. This will build your Spring Boot application. However, so far there is no logic, so it will just start a web server that doesn't do anything useful. Try it:
    `gradle bootRun`
    You should see something like:



```
> Task :bootRun

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 \\/  ___)| |_)| | | | | || (_| |  ) ) ) )
  '  |____| .__|_| |_|_| |_\__, | / / / /
 =========|_|==============|___/=/_/_/_/
 :: Spring Boot ::        (v2.1.1.RELEASE)

2018-12-04 12:31:49.041  INFO 43441 --- [           main] me.freo.hello.DemoApplication            : Starting
DemoApplication on oxsoa with PID 43441 (/home/oxsoa/ex3/hello/build/classes/java/main started by oxsoa in /ho
me/oxsoa/ex3/hello)
2018-12-04 12:31:49.046  INFO 43441 --- [           main] me.freo.hello.DemoApplication            : No active
 profile set, falling back to default profiles: default
2018-12-04 12:31:50.383  INFO 43441 --- [           main] o.s.b.w.embedded.tomcat.TomcatWebServer  : Tomcat in
itialized with port(s): 8080 (http)
2018-12-04 12:31:50.425  INFO 43441 --- [           main] o.apache.catalina.core.StandardService   : Starting
service [Tomcat]
2018-12-04 12:31:50.426  INFO 43441 --- [           main] org.apache.catalina.core.StandardEngine  : Starting
Servlet Engine: Apache Tomcat/9.0.13
2018-12-04 12:31:50.440  INFO 43441 --- [           main] o.a.catalina.core.AprLifecycleListener   : The APR b
ased Apache Tomcat Native library which allows optimal performance in production environments was not found on
 the java.library.path: [/usr/java/packages/lib/amd64:/usr/lib/x86_64-linux-gnu/jni:/lib/x86_64-linux-gnu:/usr
/lib/x86_64-linux-gnu:/usr/lib/jni:/lib:/usr/lib]
2018-12-04 12:31:50.568  INFO 43441 --- [           main] o.a.c.c.C.[Tomcat].[localhost].[/]       : Initializ
ing Spring embedded WebApplicationContext
2018-12-04 12:31:50.569  INFO 43441 --- [           main] o.s.web.context.ContextLoader            : Root WebA
pplicationContext: initialization completed in 1426 ms
2018-12-04 12:31:50.927  INFO 43441 --- [           main] o.s.b.w.embedded.tomcat.TomcatWebServer  : Tomcat st
arted on port(s): 8080 (http) with context path ''
2018-12-04 12:31:50.932  INFO 43441 --- [           main] me.freo.hello.DemoApplication            : Started D
emoApplication in 2.425 seconds (JVM running for 2.988)
<=========----> 75% EXECUTING [9s]
> :bootRun
```
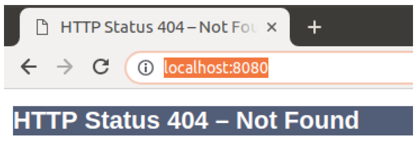

17. You can see a server is running on port 8080, but there are no resources deployed:



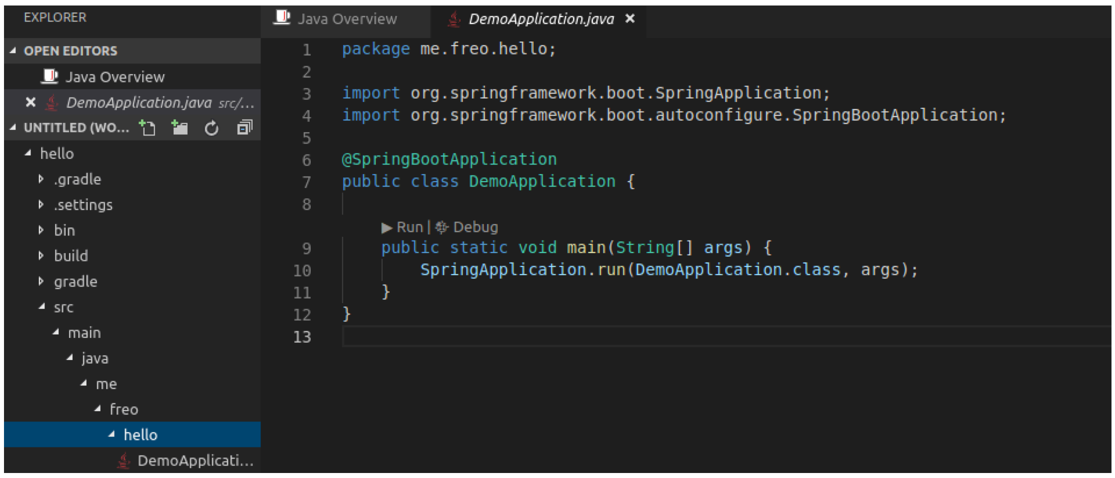
HTTP Status 404 – Not Found

18. Stop the server / gradle run by hitting Ctrl-C

19. In vscode, Open the Folder (Ctrl-K Ctrl-O, or dropdown menu)
    `~/ex3/hello`

20. You can open the src/main/java/me/freo/hello/DemoApplication.java file.

    You should see:



```
package me.freo.hello;

import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;

@SpringBootApplication
public class DemoApplication {

    public static void main(String[] args) {
        SpringApplication.run(DemoApplication.class, args);
    }
}
```

21. In the same Package (me.freo.hello), create a new Java file called **Resource.java**

22. Type the following Java. Hint if you leave out the imports, vscode will add them automatically as you do the rest.

```
package me.freo.hello;

import javax.ws.rs.GET;
import javax.ws.rs.Path;
import org.springframework.stereotype.Component;

@Component
@Path("/hello")
public class Resource {
    @GET
    @Path("/")
    public String sayHello() {
        return "hello world";
    }
}
```

    This file is our actual "Restful Service". It contains the logic to respond to HTTP requests based on the verb/path/content-type, etc

23. We need one more Java file, called **HelloConfiguration.java** (also in me/freo/hello.

24. The contents are here. Once again, vscode can help you do all this. This is basically telling Spring Boot about your Resource class.

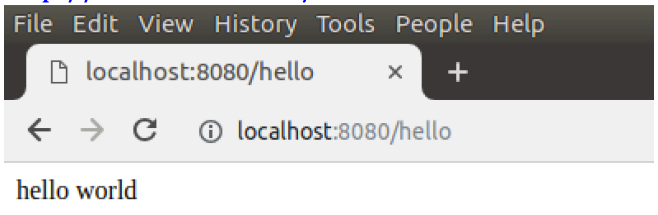
```
package me.freo.hello;

import javax.annotation.PostConstruct;
import javax.ws.rs.ApplicationPath;
import org.glassfish.jersey.server.ResourceConfig;
import org.springframework.context.annotation.Configuration;

@Configuration
@ApplicationPath("/")
public class HelloConfiguration extends ResourceConfig {
	public HelloConfiguration() {
	}

	@PostConstruct
	public void setUp() {
		register(Resource.class);
	}
}
```

25. Rebuild your gradle project and re-run:

    Hint: Ctrl-` will open a terminal window in vscode

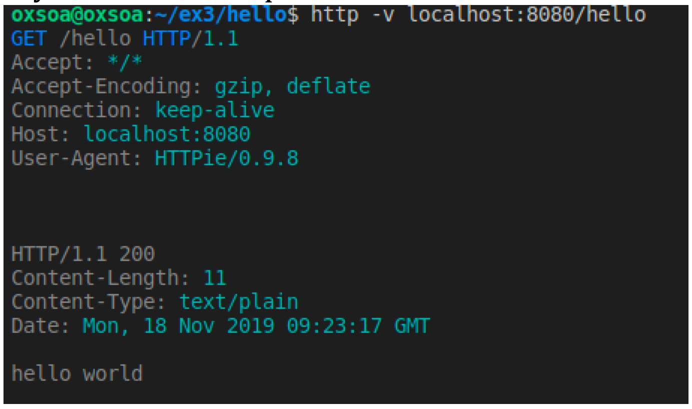
```
gradle build
gradle bootRun
```

26. Now we can see that this has created a better server. Browse to http://localhost:8080/hello



hello world

27. Try “curl -v” or “http -v”:



```
oxsoa@oxsoa:~/ex3/hello$ http -v localhost:8080/hello
GET /hello HTTP/1.1
Accept: */*
Accept-Encoding: gzip, deflate
Connection: keep-alive
Host: localhost:8080
User-Agent: HTTPie/0.9.8



HTTP/1.1 200
Content-Length: 11
Content-Type: text/plain
Date: Mon, 18 Nov 2019 09:23:17 GMT

hello world
```

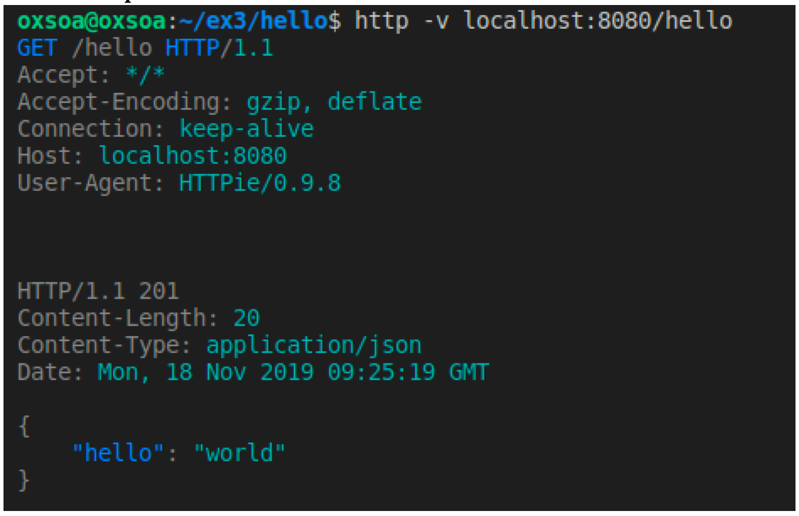
28. We are nearly done, but let’s do one final improvement to the Resource. Change Resource.java so that it looks like this:

```
package me.freo.hello;

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

import org.springframework.stereotype.Component;

@Component
@Path("/hello")
public class Resource {
    @GET
    @Produces(MediaType.APPLICATION_JSON)
    @Path("/")
    public Response sayHello() {
        return Response.status(201).entity("{ \"hello\": \"world\"} ").build();
    }
}
```

What we have done is to take full control of the HTTP response. Instead of just returning a string, we are ‘hand-crafting’ the Response object. We have also explicitly told JAX-RS to return an application/json media type.

29. Rebuild and rerun.

30. Now "http -v" this resource. You should see:



```
oxsoa@oxsoa:~/ex3/hello$ http -v localhost:8080/hello
GET /hello HTTP/1.1
Accept: */*
Accept-Encoding: gzip, deflate
Connection: keep-alive
Host: localhost:8080
User-Agent: HTTPie/0.9.8



HTTP/1.1 201
Content-Length: 20
Content-Type: application/json
Date: Mon, 18 Nov 2019 09:25:19 GMT

{
    "hello": "world"
}
```

31. Notice the different return code, and the Content-Type. And, of course, the fact that the response body is now JSON.

32. One last thing. So far we have only run this using gradle. That is really a "dev" time thing. What Spring Boot has done is to package this all up into a single executable JAR file. From the ~/ex3/hello directory type:

    ```
    java –jar build/libs/hello–0.0.1–SNAPSHOT.jar
    ```

    Once again you should see the Spring logo etc and your service has started.

33. That's all for now. We have created a simple Spring Boot project, including JAX-RS, and used gradle to build into a standalone JAR file.