



Red Hat Fuse 7.7

Deploying into Spring Boot

Building and running Spring Boot applications in standalone mode

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Abstract

This guide explains how to build Spring Boot applications that are packaged as Jar files and run directly in a JVM (standalone mode).

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CHAPTER 1. GETTING STARTED WITH SPRING BOOT STANDALONE

1.1. ABOUT SPRING BOOT STANDALONE DEPLOYMENT MODE

In standalone deployment mode, a Spring Boot application is packaged as a Jar file and run directly inside the Java Virtual Machine (JVM). This approach to packaging and running the application is consistent with the microservices philosophy, where a service is packaged with the minimum set of requirements. The Spring Boot application can be run directly using the **java** command with the **-jar** option. For example:

```
java -jar SpringBootApplication.jar
```

Where Spring Boot provides the main class for the executable Jar. The following elements are required for building a Spring Boot standalone application in Fuse:

- *The Fuse Bill of Materials (BOM)* – defines a carefully curated set of dependencies from the Red Hat Maven repository. The BOM exploits Maven’s *dependency management* mechanism to define the appropriate versions of Maven dependencies.
Note: Only the dependencies defined in the Fuse BOM are supported by Red Hat.
- *The Spring Boot Maven Plugin* – implements the build process for a standalone Spring Boot application in Maven. This plugin is responsible for packaging your Spring Boot application as an executable Jar file.

1.2. DEPLOYING INTO SPRING BOOT 2

In addition to Spring Boot 1, you also have the option of deploying into Spring Boot 2.



NOTE

For details about the OpenShift mode of deployment, see the [Fuse on OpenShift Guide](#).



NOTE

For more information on all of the differences between Spring Boot 1 and Spring Boot 2, see [Spring Boot’s Migration Guide](#) and [Spring Boot 2 Release Notes](#).

1.3. NEW CAMEL COMPONENTS FOR SPRING BOOT 2

Spring Boot 2 supports Camel version **2.23** and thus supports some new camel components that are not available for Spring Boot 1:

New Camel Components for Spring Boot 2

- as2-component
- aws-iam-component
- fhir-component
- google-calendar-stream-component

- google-mail-stream-component
- google-sheets-component
- google-sheets-stream-component
- ipfs-component
- kubernetes-hpa-component
- kubernetes-job-component
- micrometer-component
- mybatis-bean-component
- nsq-component
- rxjava2
- service-component
- spring-cloud-consul
- spring-cloud-zookeeper
- testcontainers-spring
- testcontainers
- web3j-component

CHAPTER 2. USING FUSE BOOSTERS

Red Hat Fuse provides the following boosters to help you get started with Fuse applications and demonstrate useful components:

- [Section 2.2, “Build and run the Circuit Breaker booster”](#) - An example of enabling a distributed application to cope with interruptions to network connectivity and temporary unavailability of backend services.
- [Section 2.3, “Build and run the Externalized Configuration booster”](#) - An example of how to externalize configuration for an Apache Camel route.
- [Section 2.4, “Build and run the REST API booster”](#) - An example that introduces the mechanics of interacting with a remote (exposed by Apache Camel) service using the HTTP protocol.

Prerequisites To build and run the booster demonstrations, install the following prerequisites:

- A supported version of the Java Developer Kit (JDK). See the [Supported Configurations](#) page for details.
- Apache Maven 3.3.x or later. See the Maven [Download](#) page.

2.1. GENERATING YOUR BOOSTER PROJECT

Fuse booster projects exist to help developers get started with running standalone applications. The instructions provided here guide you through generating one of those booster projects, the Circuit Breaker booster. This exercise demonstrates useful components of the Fuse on Spring Boot.

The [Netflix/Hystrix](#) circuit breaker enables distributed applications to handle interruptions to network connectivity and temporary unavailability of backend services. The basic idea of the circuit breaker pattern is that the loss of a dependent service is detected automatically and an alternative behavior can be programmed, in case the backend service is temporarily unavailable.

The Fuse circuit breaker booster consists of two related services:

- A **name** service, the backend service that returns a name to greet.
- A **greetings** service, the frontend service that invokes the **name** service to get a name and then returns the string, **Hello, NAME**.

In this booster demonstration, the Hystrix circuit breaker is inserted between the **greetings** service and the **name** service. If the backend **name** service becomes unavailable, the **greetings** service can fall back to an alternative behavior and respond to the client immediately, instead of being blocked while it waits for the **name** service to restart.

Prerequisites

- You must have access to the [Red Hat Developer Platform](#).
- You must have a supported version of the Java Developer Kit (JDK). See the [Supported Configurations](#) page for details.
- You must have [Apache Maven 3.3.x](#) or later.

Procedure

1. Navigate to <https://developers.redhat.com/launch>.
2. Click **START**.
The launcher wizard prompts you to log in to your Red Hat account.
3. Click the **Log in or register** button and then log in.
4. On the **Launcher** page, click the **Deploy an Example Application** button.
5. On the **Create Example Application** page, type the name, **fuse-circuit-breaker**, in the **Create Example Application as** field.
6. Click **Select an Example**.
7. In the **Example** dialog, select the **Circuit Breaker** option. A **Select a Runtime** dropdown menu appears.
 - a. From the **Select a Runtime** dropdown, select **Fuse**.
 - b. From the version dropdown menu, select **7.7 (Red Hat Fuse)** (do not select the **2.21.2 (Community)** version).
 - c. Click **Save**.
8. On the **Create Example Application** page, click **Download**.
9. When you see the **Your Application is Ready** dialog, click **Download.zip**. Your browser downloads the generated booster project (packaged as a ZIP file).
10. Use an archive utility to extract the generated project to a convenient location on your local file system.

2.2. BUILD AND RUN THE CIRCUIT BREAKER BOOSTER

The [Netflix/Hystrix](#) circuit breaker component enables distributed applications to cope with interruptions to network connectivity and temporary unavailability of backend services. The basic idea of the circuit breaker pattern is that the loss of a dependent service is detected automatically and an alternative behavior can be programmed, in case the backend service is temporarily unavailable.

The Fuse circuit breaker booster consists of two related services:

- A *name service*, which returns a name to greet
- A *greetings service*, which invokes the name service to get a name and then returns the string, **Hello, NAME**.

In this demonstration, the Hystrix circuit breaker is inserted between the greetings service and the name service. If the name service becomes unavailable, the greetings service can fall back to an alternative behavior and respond to the client immediately, instead of blocking or timing out while it waits for the name service to restart.

Prerequisites

- you have completed the steps mentioned in the [Section 2.1, "Generating your booster project"](#) section.

Procedure

Follow these steps to build and run the Circuit breaker booster project:

1. Open a shell prompt and build the project from the command line, using Maven:

```
cd PROJECT_DIR
mvn clean package
```

2. Open a new shell prompt and start the name service, as follows:

```
cd name-service
mvn spring-boot:run -DskipTests -Dserver.port=8081
```

As Spring Boot starts up, you should see some output like the following:

```
...
2017-12-08 15:44:24.223 INFO 22758 --- [      main]
o.a.camel.spring.SpringCamelContext : Total 1 routes, of which 1 are started
2017-12-08 15:44:24.227 INFO 22758 --- [      main]
o.a.camel.spring.SpringCamelContext : Apache Camel 2.20.0 (CamelContext: camel-1)
started in 0.776 seconds
2017-12-08 15:44:24.234 INFO 22758 --- [      main]
org.jboss.fuse.boosters.cb.Application : Started Application in 4.137 seconds (JVM running
for 4.744)
```

3. Open a new shell prompt and start the greetings service, as follows:

```
cd greetings-service
mvn spring-boot:run -DskipTests
```

As Spring Boot starts up, you should see some output like the following:

```
...
2017-12-08 15:46:58.521 INFO 22887 --- [      main] o.a.c.c.s.CamelHttpTransportServlet
: Initialized CamelHttpTransportServlet[name=CamelServlet, contextPath=]
2017-12-08 15:46:58.524 INFO 22887 --- [      main]
s.b.c.e.t.TomcatEmbeddedServletContainer : Tomcat started on port(s): 8080 (http)
2017-12-08 15:46:58.536 INFO 22887 --- [      main]
org.jboss.fuse.boosters.cb.Application : Started Application in 6.263 seconds (JVM running
for 6.819)
```

The greetings service exposes a REST endpoint at the URL, <http://localhost:8080/camel/greetings>.

4. Go to <http://localhost:8080>
When you open this page, it invokes the Greeting Service:

Greeting service

Stop

Start

Clear

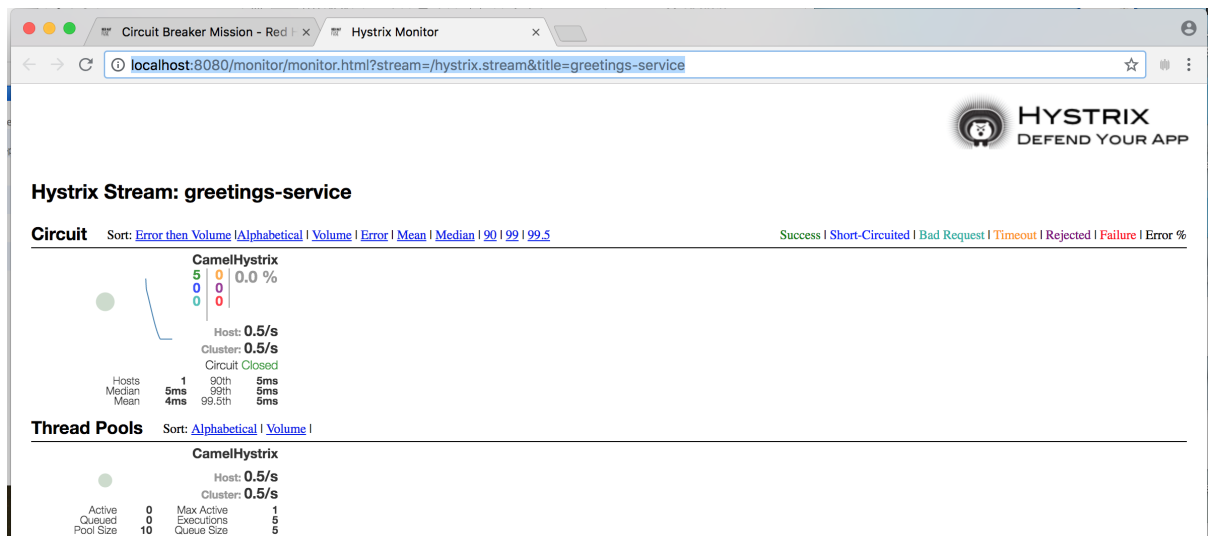
Results:

```

{"greetings":"Hello, Jacopo"}
{"greetings":"Hello, Jacopo"}
{"greetings":"Hello, Jacopo"}
{"greetings":"Hello, Jacopo"}
{"greetings":"Hello, Jacopo"}
{"greetings":"Hello, Jacopo"}
{"greetings":"Hello, Jacopo"}
{"greetings":"Hello, Jacopo"}
{"greetings":"Hello, Jacopo"}
{"greetings":"Hello, Jacopo"}

```

This page also provides a link to the Hystrix dashboard, which monitors the state of the circuit breaker.



- To demonstrate the circuit breaker functionality provided by Camel Hystrix, kill the backend name service by pressing **Ctrl+C** while in the window of the shell prompt where the name service is running.
Now that the name service is unavailable, the circuit breaker kicks in to prevent the greetings service from hanging when it is invoked.
- Observe the changes in the Hystrix Monitor dashboard and in the Greeting Service output:

Greeting service

Stop

Start

Clear

Results:

```

{"greetings":"Hello, default fallback"}
{"greetings":"Hello, default fallback"}
{"greetings":"Hello, default fallback"}
{"greetings":"Hello, default fallback"}
{"greetings":"Hello, default fallback"}
{"greetings":"Hello, default fallback"}
{"greetings":"Hello, default fallback"}
{"greetings":"Hello, default fallback"}
{"greetings":"Hello, default fallback"}
{"greetings":"Hello, default fallback"}
{"greetings":"Hello, default fallback"}
{"greetings":"Hello, Jacopo"}
{"greetings":"Hello, Jacopo"}
{"greetings":"Hello, Jacopo"}
{"greetings":"Hello, Jacopo"}
{"greetings":"Hello, Jacopo"}
{"greetings":"Hello, Jacopo"}

```

2.3. BUILD AND RUN THE EXTERNALIZED CONFIGURATION BOOSTER

The Externalized Configuration booster provides an example of how to externalize configuration for an Apache Camel route. For Spring Boot standalone deployments, the configuration data is stored in an **application.properties** file.



NOTE

For Fuse on OpenShift deployments, the configuration data is stored in a ConfigMap object.

Prerequisites

- you have completed the steps mentioned in the [Section 2.1, “Generating your booster project”](#) section.

Procedure

After you follow the [Section 2.1, “Generating your booster project”](#) steps for the **Externalized Configuration** mission, follow these steps to build and run the Externalized Configuration booster as a standalone project on your local machine:

1. Download the project and extract the archive on your local filesystem.
2. Build the project:

```

cd PROJECT_DIR
mvn clean package

```


Greeting Service

Clear

Results:

```

{"greetings":"Hello, Thomas"}
{"greetings":"Hello, Thomas"}
{"greetings":"Hello, Thomas"}
{"greetings":"Hello, Thomas"}
{"greetings":"Hello, default"}
{"greetings":"Hello, default"}
{"greetings":"Hello, default"}
{"greetings":"Hello, default"}

```

2.4. BUILD AND RUN THE REST API BOOSTER

The REST API Level 0 mission shows how to map business operations to a remote procedure call endpoint over HTTP by using a REST framework. This mission corresponds to Level 0 in the Richardson Maturity Model.

The REST API booster introduces the mechanics of interacting with a remote (exposed by Apache Camel) service using the HTTP protocol. By using this Fuse booster, you can quickly prototype and flexibly design a REST API.

Use this booster to:

- Execute an HTTP GET request on the **camel/greetings/{name}** endpoint. This request produces a response in JSON format with a payload of **Hello, \$name!** (where **\$name** is replaced by the value of the URL parameter from the HTTP GET request).
- Change the value of the URL **{name}** parameter to see the changed value reflected in the response.
- View the REST API's Swagger page.

Prerequisites

- you have completed the steps mentioned in the [Section 2.1, "Generating your booster project"](#) section.

Procedure

Follow these steps to build and run the REST API booster as a standalone project on your local machine:

1. Download the project and extract the archive on your local filesystem.
2. Build the project:

```

cd PROJECT_DIR
mvn clean package

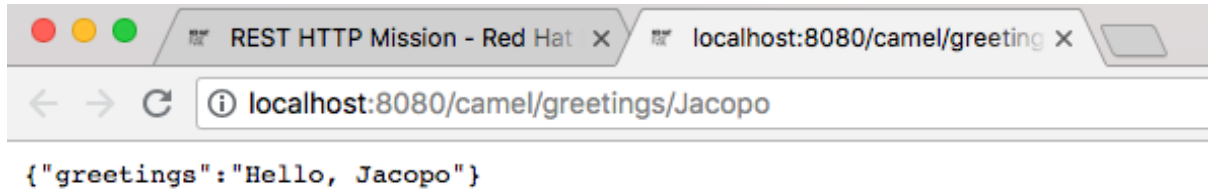
```

3. Run the service:

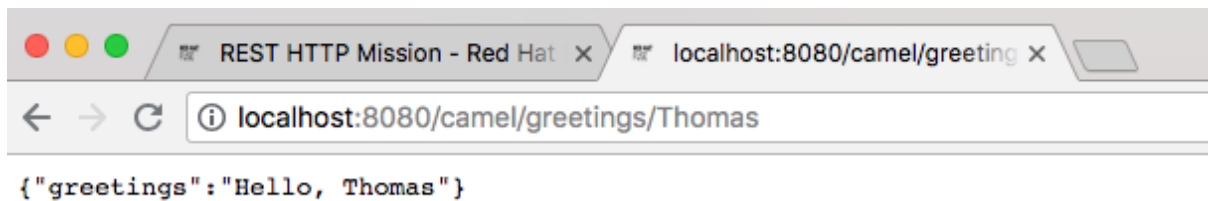
```
mvn spring-boot:run
```

4. Open a web browser to: <http://localhost:8080>
5. To execute the example HTTP GET request, click the `camel/greetings/{name}` button. A new web browser window opens with the `localhost:8080/camel/greetings/Jacopo` URL. The default value of the URL `{name}` parameter is `Jacopo`.

The JSON response appears in the browser window:



6. To change the value of the `{name}` parameter, change the URL. For example, to change the name to `Thomas`, use this URL: `localhost:8080/camel/greetings/Thomas`. The updated JSON response appears in the browser window:



7. To view the REST API's Swagger page, click the API Swagger page button. The API swagger page opens in a browser window.

The screenshot shows a web browser window with the Swagger UI interface. The browser tabs include "REST HTTP Mission - Red X", "Swagger UI", and "localhost:8080/camel/gre X". The address bar shows the URL "localhost:8080/webjars/swagger-ui/index.html?url=/camel/api-doc&validatorUrl=".

The Swagger UI header is green and contains the Swagger logo, the text "swagger", the API path "/camel/api-doc", and an "Explore" button.

The main content area displays the API title "Greeting REST API" with a version indicator "1.0". Below the title, it shows the base URL "[Base URL: /camel/]" and a link to "/camel/api-doc".

Under the "Schemes" section, a dropdown menu is set to "HTTP".

The "greetings/" endpoint is shown with the description "Greeting to {name}". Below this, a "GET" method is listed with the path "/greetings/{name}".

Under the "Models" section, a "Greetings" model is listed with a right-pointing arrow.

CHAPTER 3. BUILDING WITH MAVEN

The standard approach to developing applications for Spring Boot in Fuse is to use the Apache Maven build tool and to structure your source code as a Maven project. Fuse provides Maven quickstarts to get you started quickly and many of the Fuse build tools are provided as Maven plug-ins. For this reason, it is highly recommended that you adopt Maven as the build tool for Spring Boot projects in Fuse.

3.1. GENERATING A MAVEN PROJECT

Fuse provides a selection of quickstarts, based on Maven archetypes, which you can use to generate an initial Maven project for a Spring Boot application. To prevent you from having to remember the location information and versions for various Maven archetypes, Fuse provides tooling to help you generate Maven projects for standalone Spring Boot projects.

3.1.1. Project generator at developers.redhat.com/launch

The quickest way to get started with Spring Boot standalone in Fuse is to navigate to developers.redhat.com/launch and follow the instructions for the Spring Boot standalone runtime, to generate a new Maven project. After following the on-screen instructions, you will be prompted to download an archive file, which contains a complete Maven project that you can build and run locally.

3.1.2. Fuse tooling wizard in Developer Studio

Alternatively, you can download and install Red Hat JBoss Developer Studio (which includes Fuse Tooling). Using the **Fuse New Integration Project** wizard, you can generate a new Spring Boot standalone project and continue to develop inside the Eclipse-based IDE.

3.2. USING SPRING BOOT BOM

After creating and building your first Spring Boot project, you will soon want to add more components. But how do you know which versions of the Maven dependencies to add to your project? The simplest (and recommended) approach is to use the relevant Bill of Materials (BOM) file, which automatically defines all of the version dependencies for you.

3.2.1. BOM file for Spring Boot

The purpose of a [Maven Bill of Materials \(BOM\)](#) file is to provide a curated set of Maven dependency versions that work well together, preventing you from having to define versions individually for every Maven artifact.



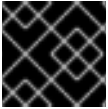
IMPORTANT

Ensure you are using the correct Fuse BOM based on the version of Spring Boot you are using (Spring Boot 1 or Spring Boot 2).

The Fuse BOM for Spring Boot offers the following advantages:

- Defines versions for Maven dependencies, so that you do not need to specify the version when you add a dependency to your POM.
- Defines a set of curated dependencies that are fully tested and supported for a specific version of Fuse.

- Simplifies upgrades of Fuse.



IMPORTANT

Only the set of dependencies defined by a Fuse BOM are supported by Red Hat.

3.2.2. Incorporate the BOM file

To incorporate a BOM file into your Maven project, specify a **dependencyManagement** element in your project's **pom.xml** file (or, possibly, in a parent POM file), as shown in the examples for both Spring Boot 2 and Spring Boot 1 below:

- [Spring Boot 2 BOM](#)
- [Spring Boot 1 BOM](#)

Spring Boot 2 BOM

```
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<project ...>
...
<properties>
  <project.build.sourceEncoding>UTF-8</project.build.sourceEncoding>

  <!-- configure the versions you want to use here -->
  <fuse.version>7.7.0.fuse-sb2-770010-redhat-00001</fuse.version>
</properties>

<dependencyManagement>
  <dependencies>
    <dependency>
      <groupId>org.jboss.redhat-fuse</groupId>
      <artifactId>fuse-springboot-bom</artifactId>
      <version>${fuse.version}</version>
      <type>pom</type>
      <scope>import</scope>
    </dependency>
  </dependencies>
</dependencyManagement>
...
</project>
```

Spring Boot 1 BOM

```
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<project ...>
...
<properties>
  <project.build.sourceEncoding>UTF-8</project.build.sourceEncoding>

  <!-- configure the versions you want to use here -->
  <fuse.version>7.7.0.fuse-770012-redhat-00003</fuse.version>
</properties>
```

```

<dependencyManagement>
  <dependencies>
    <dependency>
      <groupId>org.jboss.redhat-fuse</groupId>
      <artifactId>fuse-springboot-bom</artifactId>
      <version>${fuse.version}</version>
      <type>pom</type>
      <scope>import</scope>
    </dependency>
  </dependencies>
</dependencyManagement>
...
</project>

```

After specifying the BOM using the dependency management mechanism, it is possible to add Maven dependencies to your POM *without* specifying the version of the artifact. For example, to add a dependency for the **camel-hystrix** component, you would add the following XML fragment to the **dependencies** element in your POM:

```

<dependency>
  <groupId>org.apache.camel</groupId>
  <artifactId>camel-hystrix-starter</artifactId>
</dependency>

```

Note how the Camel artifact ID is specified with the **-starter** suffix – that is, you specify the Camel Hystrix component as **camel-hystrix-starter**, not as **camel-hystrix**. The Camel starter components are packaged in a way that is optimized for the Spring Boot environment.

3.2.3. Spring Boot Maven plugin

The Spring Boot Maven plugin is provided by Spring Boot and it is a developer utility for building and running a Spring Boot project:

- *Building* – create an executable Jar package for your Spring Boot application by entering the command **mvn package** in the project directory. The output of the build is placed in the **target/** subdirectory of your Maven project.
- *Running* – for convenience, you can run the newly-built application with the command, **mvn spring-boot:start**.

To incorporate the Spring Boot Maven plugin into your project POM file, add the plugin configuration to the **project/build/plugins** section of your **pom.xml** file, as shown in the following example.

Example

```

<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<project ...>
  ...
  <properties>
    <project.build.sourceEncoding>UTF-8</project.build.sourceEncoding>

    <!-- configure the versions you want to use here -->
    <fuse.version>7.7.0.fuse-770012-redhat-00003</fuse.version>

```

```
</properties>
...
<build>
  <plugins>
    <plugin>
      <groupId>org.jboss.redhat-fuse</groupId>
      <artifactId>spring-boot-maven-plugin</artifactId>
      <version>${fuse.version}</version>
      <executions>
        <execution>
          <goals>
            <goal>repackage</goal>
          </goals>
        </execution>
      </executions>
    </plugin>
  </plugins>
</build>
...
</project>
```

CHAPTER 4. RUNNING APACHE CAMEL APPLICATION IN SPRING BOOT

The Apache Camel Spring Boot component automatically configures Camel context for Spring Boot. Auto-configuration of the Camel context automatically detects the Camel routes available in the Spring context and registers the key Camel utilities such as producer template, consumer template, and the type converter as beans. The Apache Camel component includes a Spring Boot starter module that allows you to develop Spring Boot applications by using starters.

4.1. INTRODUCTION TO THE CAMEL SPRING BOOT COMPONENT

Every Camel Spring Boot application must use the **dependencyManagement** element in the project's **pom.xml** to specify the productized versions of the dependencies. These dependencies are defined in the Red Hat Fuse BOM and are supported for the specific version of Red Hat Fuse. You can omit the version number attribute for the additional starters so as not to override the versions from BOM. See [quickstart pom](#) for more information.

Example

```
<dependencyManagement>
<dependencies>
<dependency>
<groupId>org.jboss.redhat-fuse</groupId>
<artifactId>fuse-springboot-bom</artifactId>
<version>${fuse.version}</version>
<type>pom</type>
<scope>import</scope>
</dependency>
</dependencies>
</dependencyManagement>
```



NOTE

The **camel-spring-boot** jar contains with the **spring.factories** file which allows you to add that dependency to your classpath so Spring Boot will automatically configure Camel context.

4.2. INTRODUCTION TO THE CAMEL SPRING BOOT STARTER MODULE

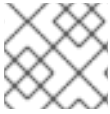
Starter are the Apache Camel modules that are intended to be used in Spring Boot applications. There is a **camel-xxx-starter** module for each Camel component (with a few exceptions listed in the [Section 4.3, "List of the Camel components that do not have starter modules"](#) section).

Starter meet the following requirements:

- Allow auto-configuration of the component by using the native Spring Boot configuration system which is compatible with IDE tooling.
- Allow auto-configuration of data formats and languages.
- Manage transitive logging dependencies to integrate with the Spring Boot logging system.

- Include additional dependencies and align transitive dependencies to minimize the effort of creating a working Spring Boot application.

Each starter has its own integration test in **tests/camel-itest-spring-boot**, that verifies the compatibility with the current release of Spring Boot.



NOTE

For more details, see [sample application](#) in the source code.

4.3. LIST OF THE CAMEL COMPONENTS THAT DO NOT HAVE STARTER MODULES

The following components do not have starter modules because of compatibility issues:

- **camel-blueprint** (intended for OSGi only)
- **camel-cdi** (intended for CDI only)
- **camel-core-osgi** (intended for OSGi only)
- **camel-ejb** (intended for JEE only)
- **camel-eventadmin** (intended for OSGi only)
- **camel-ibatis** (**camel-mybatis-starter** is included)
- **camel-jclouds**
- **camel-mina** (**camel-mina2-starter** is included)
- **camel-paxlogging** (intended for OSGi only)
- **camel-quartz** (**camel-quartz2-starter** is included)
- **camel-spark-rest**
- **camel-openapi-java** (**camel-openapi-java-starter** is included)

4.4. USING CAMEL SPRING BOOT STARTER

Apache Camel provides a starter module that allows you to quickly get started developing Spring Boot applications.

Procedure

1. Add the following dependency to your Spring Boot pom.xml file:

```
<dependency>
  <groupId>org.apache.camel</groupId>
  <artifactId>camel-spring-boot-starter</artifactId>
</dependency>
```

2. Add the classes with your Camel routes as shown in the snippet below. Once these routes are added to the class path the routes are started automatically.

```

package com.example;

import org.apache.camel.builder.RouteBuilder;
import org.springframework.stereotype.Component;

@Component
public class MyRoute extends RouteBuilder {

    @Override
    public void configure() throws Exception {
        from("timer:foo")
            .to("log:bar");
    }
}

```

3. Optional. To keep the main thread blocked so that Camel stays up, do one of the following.
 - a. Include the **spring-boot-starter-web** dependency,
 - b. Or add **camel.springboot.main-run-controller=true** to your **application.properties** or **application.yml** file.
You can customize the Camel application in the **application.properties** or **application.yml** file with **camel.springboot.* properties**.
4. Optional. To refer to a custom bean by using the bean's ID name, configure the options in the **src/main/resources/application.properties** (or the **application.yml**) file. The following example shows how the xslt component refers to a custom bean by using the bean ID.
 - a. Refer to a custom bean by the id **myExtensionFactory**.

```
camel.component.xslt.saxon-extension-functions=myExtensionFactory
```

- b. Then create the custom bean using Spring Boot `@Bean` annotation.

```

@Bean(name = "myExtensionFactory")
public ExtensionFunctionDefinition myExtensionFactory() {
}

```

Or, for a Jackson ObjectMapper, in the **camel-jackson** data-format:

```
camel.dataformat.json-jackson.object-mapper=myJacksonMapper
```

4.5. ABOUT CAMEL CONTEXT AUTO-CONFIGURATION FOR SPRING BOOT

Camel Spring Boot auto-configuration provides a **CamelContext** instance and creates a **SpringCamelContext**. It also initializes and performs shutdown of that context. This Camel context is registered in the Spring application context under **camelContext** bean name and you can access it like other Spring bean. You can access the **camelContext** as shown below.

Example

```
@Configuration
```



```
public class MyAppConfig {

    @Autowired
    CamelContext camelContext;

    @Bean
    MyService myService() {
        return new DefaultMyService(camelContext);
    }

}
```

4.6. AUTO-DETECTING CAMEL ROUTES IN SPRING BOOT APPLICATIONS

Camel auto-configuration collects all the **RouteBuilder** instances from the Spring context and automatically injects them into the **CamelContext**. This simplifies the process of creating a new Camel route with the Spring Boot starter. You can create the routes as follows:

Example

Add the **@Component** annotated class to your classpath.

```
@Component
public class MyRouter extends RouteBuilder {

    @Override
    public void configure() throws Exception {
        from("jms:invoices").to("file:/invoices");
    }

}
```

Or create a new route **RouteBuilder** bean in your **@Configuration** class.

```
@Configuration
public class MyRouterConfiguration {

    @Bean
    RoutesBuilder myRouter() {
        return new RouteBuilder() {

            @Override
            public void configure() throws Exception {
                from("jms:invoices").to("file:/invoices");
            }

        };
    }

}
```

4.7. CONFIGURING CAMEL PROPERTIES FOR CAMEL SPRING BOOT AUTO-CONFIGURATION

Spring Boot auto-configuration connects to the Spring Boot external configuration such as properties placeholders, OS environment variables, or system properties with Camel properties support.

Procedure

1. Define the properties either in the **application.properties** file:

```
route.from = jms:invoices
```

Or set the Camel properties as the system properties, for example:

```
java -Droute.to=jms:processed.invoices -jar mySpringApp.jar
```

2. Use the configured properties as placeholders in Camel route as follows.

```
@Component
public class MyRouter extends RouteBuilder {

    @Override
    public void configure() throws Exception {
        from("${route.from}").to("${route.to}");
    }
}
```

4.8. CONFIGURING CUSTOM CAMEL CONTEXT

To perform operations on the **CamelContext** bean created by Camel Spring Boot auto-configuration, register a **CamelContextConfiguration** instance in your Spring context.

Procedure

- Register an instance of **CamelContextConfiguration** in the Spring context as shown below.

```
@Configuration
public class MyAppConfig {

    ...

    @Bean
    CamelContextConfiguration contextConfiguration() {
        return new CamelContextConfiguration() {
            @Override
            void beforeApplicationStart(CamelContext context) {
                // your custom configuration goes here
            }
        };
    }
}
```

The **CamelContextConfiguration** and **beforeApplicationStart(CamelContext)** methods are called before the Spring context is started, so the **CamelContext** instance that is passed to this callback is fully auto-configured. You can add many instances of **CamelContextConfiguration** into your Spring context and all of them will be executed.

4.9. DISABLING JMX IN THE AUTO-CONFIGURED CAMELCONTEXT

To disable JMX in the auto-configured **CamelContext**, you can use the **camel.springboot.jmxEnabled** property as JMX is enabled by default.

Procedure

- Add the following property to your **application.properties** file and set it to **false**:

```
camel.springboot.jmxEnabled = false
```

4.10. INJECTING AUTO-CONFIGURED CONSUMER AND PRODUCER TEMPLATES INTO SPRING-MANAGED BEANS

Camel auto configuration provides pre-configured **ConsumerTemplate** and **ProducerTemplate** instances. You can inject them into your Spring-managed beans.

Example

```
@Component
public class InvoiceProcessor {

    @Autowired
    private ProducerTemplate producerTemplate;

    @Autowired
    private ConsumerTemplate consumerTemplate;
    public void processNextInvoice() {
        Invoice invoice = consumerTemplate.receiveBody("jms:invoices", Invoice.class);
        ...
        producerTemplate.sendBody("netty-http:http://invoicing.com/received/" + invoice.id());
    }
}
```

By default consumer templates and producer templates come with the endpoint cache sizes set to 1000. You can change these values by setting the following Spring properties to the desired cache size, for example:

```
camel.springboot.consumerTemplateCacheSize = 100
camel.springboot.producerTemplateCacheSize = 200
```

4.11. ABOUT THE AUTO-CONFIGURED TYPECONVERTER IN THE SPRING CONTEXT

Camel auto configuration registers a **TypeConverter** instance named **typeConverter** in the Spring context.

Example

```

@Component
public class InvoiceProcessor {

    @Autowired
    private TypeConverter typeConverter;

    public long parseInvoiceValue(Invoice invoice) {
        String invoiceValue = invoice.grossValue();
        return typeConverter.convertTo(Long.class, invoiceValue);
    }
}

```

4.12. SPRING TYPE CONVERSION API BRIDGE

Spring consist of a powerful [type conversion API](#). Spring API is similar to the Camel [type converter API](#). Due to the similarities between the two APIs Camel Spring Boot automatically registers a bridge converter (**SpringTypeConverter**) that delegates to the Spring conversion API. This means that out-of-the-box Camel will treat Spring Converters similar to Camel.

This allows you to access both Camel and Spring converters using the Camel **TypeConverter** API, as shown below:

Example

```

@Component
public class InvoiceProcessor {

    @Autowired
    private TypeConverter typeConverter;

    public UUID parseInvoiceId(Invoice invoice) {
        // Using Spring's StringToUUIDConverter
        UUID id = invoice.typeConverter.convertTo(UUID.class, invoice.getId());
    }
}

```

Here, Spring Boot delegates conversion to the Spring's **ConversionService** instances available in the application context. If no **ConversionService** instance is available, Camel Spring Boot auto configuration creates an instance of **ConversionService**.

4.13. DISABLING TYPE CONVERSIONS FEATURES

To disable the Camel Spring Boot type conversion features, set the **camel.springboot.typeConversion** property to **false**. When this property is set to **false**, the auto-configuration does not register a type converter instance and does not enable the delegation of type conversion to the Spring Boot type conversion API.

Procedure

- To disable the type conversion features of Camel Spring Boot component, set the `camel.springboot.typeConversion` property to **false** as shown below:

```
camel.springboot.typeConversion = false
```

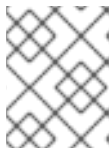
4.14. ADDING XML ROUTES TO THE CLASSPATH FOR AUTO-CONFIGURATION

By default, the Camel Spring Boot component auto-detects and includes the Camel XML routes that are in the classpath in the **camel** directory. You can configure the directory name or disable this feature using the configuration option.

Procedure

- Configure the Camel Spring Boot XML routes in the classpath as follows.

```
// turn off
camel.springboot.xmlRoutes = false
// scan in the com/foo/routes classpath
camel.springboot.xmlRoutes = classpath:com/foo/routes/*.xml
```



NOTE

The XML files should define the Camel XML route elements and not **CamelContext** elements, for example:

```
<routes xmlns="http://camel.apache.org/schema/spring">
  <route id="test">
    <from uri="timer://trigger"/>
    <transform>
      <simple>ref:myBean</simple>
    </transform>
    <to uri="log:out"/>
  </route>
</routes>
```

Using Spring XML files

To use Spring XML files with the `<camelContext>`, you can configure a Camel context in the Spring XML file or in the **application.properties** file. To set the name of the Camel context and turn on the stream caching, add the following in the **application.properties** file:

```
camel.springboot.name = MyCamel
camel.springboot.stream-caching-enabled=true
```

4.15. ADDING XML REST-DSL ROUTES FOR AUTO-CONFIGURATION

The Camel Spring Boot component auto-detects and embeds the Camel Rest-DSL XML routes that are added in the classpath under the **camel-rest** directory. You can configure the directory name or disable this feature using the configuration option.

Procedure

- Configure the Camel Spring Boot Rest-DSL XML routes in the classpath as follows.

```
// turn off
camel.springboot.xmlRests = false
// scan in the com/foo/routes classpath
camel.springboot.xmlRests = classpath:com/foo/rests/*.xml
```



NOTE

The Rest-DSL XML files should define the Camel XML REST elements and not **CamelContext** elements, for example:

```
<rests xmlns="http://camel.apache.org/schema/spring">
  <rest>
    <post uri="/persons">
      <to uri="direct:postPersons"/>
    </post>
    <get uri="/persons">
      <to uri="direct:getPersons"/>
    </get>
    <get uri="/persons/{personId}">
      <to uri="direct:getPersonId"/>
    </get>
    <put uri="/persons/{personId}">
      <to uri="direct:putPersonId"/>
    </put>
    <delete uri="/persons/{personId}">
      <to uri="direct:deletePersonId"/>
    </delete>
  </rest>
</rests>
```

4.16. TESTING WITH CAMEL SPRING BOOT

When Camel runs on the Spring Boot, Spring Boot automatically embeds Camel and all its routes, which are annotated with **@Component**. When testing with Spring Boot use **@SpringBootTest** instead of **@ContextConfiguration** to specify which configuration class to use.

When you have multiple Camel routes in different RouteBuilder classes, the Camel Spring Boot component automatically embeds all these routes when running the application. Hence, when you wish to test routes from only one RouteBuilder class you can use the following patterns to include or exclude which RouteBuilders to enable:

- `java-routes-include-pattern`: Used for including RouteBuilder classes that match the pattern.
- `java-routes-exclude-pattern`: Used for excluding RouteBuilder classes that match the pattern. Exclude takes precedence over include.

Procedure

1. Specify the **include** or **exclude** patterns in your unit test classes as properties to **@SpringBootTest** annotation, as shown below:

```

@RunWith(CamelSpringBootRunner.class)
@SpringBootTest(classes = {MyApplication.class};
    properties = {"camel.springboot.java-routes-include-pattern=**/Foo*"})
public class FooTest {

```

In the **FooTest** class, the include pattern is ****/Foo***, which represents an Ant style pattern. Here, the pattern starts with a double asterisk, which matches with any leading package name. **/Foo*** means the class name must start with Foo, for example, FooRoute.

2. Run the test using the following maven command:

```
mvn test -Dtest=FooTest
```

Additional Resources

- [Configuring Camel](#)
- [Component](#)
- [Endpoint](#)
- [Getting Started](#)

4.17. USING SPRING BOOT, APACHE CAMEL AND EXTERNAL MESSAGING BROKERS

Fuse uses external messaging brokers. See [Supported Configurations](#) for more information about the supported broker, client and Camel component combinations.

The Camel component must be connected to the JMS connection-factory. The example below shows how to connect the **camel-amqp** component to a JMS connection-factory.

```

import org.apache.activemq.jms.pool.PooledConnectionFactory;
import org.apache.camel.component.amqp.AMQPComponent;
import org.apache.qpid.jms.JmsConnectionFactory;
...

AMQPComponent amqpComponent(AMQPConfiguration config) {
    JmsConnectionFactory qpid = new JmsConnectionFactory(config.getUsername(),
config.getPassword(), "amqp://" + config.getHost() + ":" + config.getPort());
    qpid.setTopicPrefix("topic://");

    PooledConnectionFactory factory = new PooledConnectionFactory();
    factory.setConnectionFactory(qpid);

    AMQPComponent amqpcomp = new AMQPComponent(factory);

```

APPENDIX A. PREPARING TO USE MAVEN

This section gives a brief overview of how to prepare Maven for building Red Hat Fuse projects and introduces the concept of Maven coordinates, which are used to locate Maven artifacts.

A.1. PREPARING TO SET UP MAVEN

Maven is a free, open source, build tool from Apache. Typically, you use Maven to build Fuse applications.

Procedure

1. Download the latest version of Maven from the [Maven download page](#).
2. Ensure that your system is connected to the Internet.
While building a project, the default behavior is that Maven searches external repositories and downloads the required artifacts. Maven looks for repositories that are accessible over the Internet.

You can change this behavior so that Maven searches only repositories that are on a local network. That is, Maven can run in an offline mode. In offline mode, Maven looks for artifacts in its local repository. See [Section A.3, "Using local Maven repositories"](#).

A.2. ADDING RED HAT REPOSITORIES TO MAVEN

To access artifacts that are in Red Hat Maven repositories, you need to add those repositories to Maven's **settings.xml** file. Maven looks for the **settings.xml** file in the **.m2** directory of the user's home directory. If there is not a user specified **settings.xml** file, Maven uses the system-level **settings.xml** file at **M2_HOME/conf/settings.xml**.

Prerequisite

You know the location of the **settings.xml** file in which you want to add the Red Hat repositories.

Procedure

In the **settings.xml** file, add **repository** elements for the Red Hat repositories as shown in this example:

```
<?xml version="1.0"?>
<settings>

<profiles>
<profile>
<id>extra-repos</id>
<activation>
<activeByDefault>true</activeByDefault>
</activation>
<repositories>
<repository>
<id>redhat-ga-repository</id>
<url>https://maven.repository.redhat.com/ga</url>
<releases>
<enabled>true</enabled>
</releases>
<snapshots>
```



```

        <enabled>false</enabled>
    </snapshots>
</repository>
<repository>
    <id>redhat-ea-repository</id>
    <url>https://maven.repository.redhat.com/earlyaccess/all</url>
    <releases>
        <enabled>true</enabled>
    </releases>
    <snapshots>
        <enabled>false</enabled>
    </snapshots>
</repository>
<repository>
    <id>jboss-public</id>
    <name>JBoss Public Repository Group</name>
    <url>https://repository.jboss.org/nexus/content/groups/public/</url>
</repository>
</repositories>
<pluginRepositories>
<pluginRepository>
    <id>redhat-ga-repository</id>
    <url>https://maven.repository.redhat.com/ga</url>
    <releases>
        <enabled>true</enabled>
    </releases>
    <snapshots>
        <enabled>false</enabled>
    </snapshots>
</pluginRepository>
<pluginRepository>
    <id>redhat-ea-repository</id>
    <url>https://maven.repository.redhat.com/earlyaccess/all</url>
    <releases>
        <enabled>true</enabled>
    </releases>
    <snapshots>
        <enabled>false</enabled>
    </snapshots>
</pluginRepository>
<pluginRepository>
    <id>jboss-public</id>
    <name>JBoss Public Repository Group</name>
    <url>https://repository.jboss.org/nexus/content/groups/public</url>
</pluginRepository>
</pluginRepositories>
</profile>
</profiles>

<activeProfiles>
    <activeProfile>extra-repos</activeProfile>
</activeProfiles>

</settings>

```

A.3. USING LOCAL MAVEN REPOSITORIES

If you are running the Apache Karaf container without an Internet connection, and you need to deploy an application that has dependencies that are not available offline, you can use the Maven dependency plug-in to download the application's dependencies into a Maven offline repository. You can then distribute this customized Maven offline repository to machines that do not have an Internet connection.

Procedure

1. In the project directory that contains the **pom.xml** file, download a repository for a Maven project by running a command such as the following:

```
mvn org.apache.maven.plugins:maven-dependency-plugin:3.1.0:go-offline -
Dmaven.repo.local=/tmp/my-project
```

In this example, Maven dependencies and plug-ins that are required to build the project are downloaded to the **/tmp/my-project** directory.

2. Edit the **etc/org.ops4j.pax.url.mvn.cfg** file to set **org.ops4j.pax.url.mvn.offline** to true. This enables offline mode:

```
##
# If set to true, no remote repository will be accessed when resolving artifacts
#
org.ops4j.pax.url.mvn.offline = true
```

3. Distribute this customized Maven offline repository internally to any machines that do not have an Internet connection.

A.4. ABOUT MAVEN ARTIFACTS AND COORDINATES

In the Maven build system, the basic building block is an *artifact*. After a build, the output of an artifact is typically an archive, such as a JAR or WAR file.

A key aspect of Maven is the ability to locate artifacts and manage the dependencies between them. A *Maven coordinate* is a set of values that identifies the location of a particular artifact. A basic coordinate has three values in the following form:

groupId:artifactId:version

Sometimes Maven augments a basic coordinate with a *packaging* value or with both a *packaging* value and a *classifier* value. A Maven coordinate can have any one of the following forms:

```
groupId:artifactId:version
groupId:artifactId:packaging:version
groupId:artifactId:packaging:classifier:version
```

Here are descriptions of the values:

groupId

Defines a scope for the name of the artifact. You would typically use all or part of a package name as a group ID. For example, **org.fusesource.example**.

artifactId

Defines the artifact name relative to the group ID.

version

Specifies the artifact's version. A version number can have up to four parts: **n.n.n.n**, where the last part of the version number can contain non-numeric characters. For example, the last part of **1.0-SNAPSHOT** is the alphanumeric substring, **0-SNAPSHOT**.

packaging

Defines the packaged entity that is produced when you build the project. For OSGi projects, the packaging is **bundle**. The default value is **jar**.

classifier

Enables you to distinguish between artifacts that were built from the same POM, but have different content.

Elements in an artifact's POM file define the artifact's group ID, artifact ID, packaging, and version, as shown here:

```
<project ... >
...
<groupId>org.fusesource.example</groupId>
<artifactId>bundle-demo</artifactId>
<packaging>bundle</packaging>
<version>1.0-SNAPSHOT</version>
...
</project>
```

To define a dependency on the preceding artifact, you would add the following **dependency** element to a POM file:

```
<project ... >
...
<dependencies>
<dependency>
  <groupId>org.fusesource.example</groupId>
  <artifactId>bundle-demo</artifactId>
  <version>1.0-SNAPSHOT</version>
</dependency>
</dependencies>
...
</project>
```



NOTE

It is not necessary to specify the **bundle** package type in the preceding dependency, because a bundle is just a particular kind of JAR file and **jar** is the default Maven package type. If you do need to specify the packaging type explicitly in a dependency, however, you can use the **type** element.

APPENDIX B. SPRING BOOT MAVEN PLUGIN

Spring Boot Maven plugin provides the Spring Boot support in Maven and allows you to package the executable **jar** or **war** archives and run an application **in-place**.

B.1. SPRING BOOT MAVEN PLUGIN GOALS

The Spring Boot Maven plugin includes the following goals:

- **spring-boot:run** runs your Spring Boot application.
- **spring-boot:repackage** repackages your **.jar** and **.war** files to be executable.
- **spring-boot:start** and **spring-boot:stop** both are used to manage the lifecycle of your Spring Boot application.
- **spring-boot:build-info** generates build information that can be used by the Actuator.

B.2. USING SPRING BOOT MAVEN PLUGIN

You can find general instructions on how to use the Spring Boot Plugin at: <http://docs.spring.io/spring-boot/docs/current/maven-plugin/usage.html>. The following examples illustrates the usage of the **spring-boot-maven-plugin** for Spring Boot.

- [Spring Boot 2 Example](#)
- [Spring Boot 1 Example](#)



NOTE

For more information on Spring Boot Maven Plugin, refer the <http://docs.spring.io/spring-boot/docs/current/maven-plugin> link.

B.2.1. Using Spring Boot Maven plugin for Spring Boot 2

The following example illustrates the usage of the **spring-boot-maven-plugin** for Spring Boot 2.

Example

```
<project>
  <modelVersion>4.0.0</modelVersion>

  <groupId>com.redhat.fuse</groupId>
  <artifactId>spring-boot-camel</artifactId>
  <version>1.0-SNAPSHOT</version>

  <properties>
    <project.build.sourceEncoding>UTF-8</project.build.sourceEncoding>
    <project.reporting.outputEncoding>UTF-8</project.reporting.outputEncoding>

    <!-- configure the Fuse version you want to use here -->
    <fuse.bom.version>7.7.0.fuse-sb2-770010-redhat-00001</fuse.bom.version>

    <!-- maven plugin versions -->
```

```

<maven-compiler-plugin.version>3.7.0</maven-compiler-plugin.version>
<maven-surefire-plugin.version>2.19.1</maven-surefire-plugin.version>
</properties>

<build>
  <defaultGoal>spring-boot:run</defaultGoal>

  <plugins>
    <plugin>
      <groupId>org.jboss.redhat-fuse</groupId>
      <artifactId>spring-boot-maven-plugin</artifactId>
      <version>${fuse.bom.version}</version>
      <executions>
        <execution>
          <goals>
            <goal>repackage</goal>
          </goals>
        </execution>
      </executions>
    </plugin>
  </plugins>
</build>

<repositories>
  <repository>
    <id>redhat-ga-repository</id>
    <url>https://maven.repository.redhat.com/ga</url>
    <releases>
      <enabled>true</enabled>
    </releases>
    <snapshots>
      <enabled>false</enabled>
    </snapshots>
  </repository>
  <repository>
    <id>redhat-ea-repository</id>
    <url>https://maven.repository.redhat.com/earlyaccess/all</url>
    <releases>
      <enabled>true</enabled>
    </releases>
    <snapshots>
      <enabled>false</enabled>
    </snapshots>
  </repository>
</repositories>

<pluginRepositories>
  <pluginRepository>
    <id>redhat-ga-repository</id>
    <url>https://maven.repository.redhat.com/ga</url>
    <releases>
      <enabled>true</enabled>
    </releases>
    <snapshots>
      <enabled>false</enabled>

```

```

    </snapshots>
  </pluginRepository>
</pluginRepository>
  <id>redhat-ea-repository</id>
  <url>https://maven.repository.redhat.com/earlyaccess/all</url>
  <releases>
    <enabled>true</enabled>
  </releases>
  <snapshots>
    <enabled>>false</enabled>
  </snapshots>
</pluginRepository>
</pluginRepositories>
</project>

```

B.2.2. Using Spring Boot Maven plugin for Spring Boot 1

The following example illustrates the usage of the **spring-boot-maven-plugin** for Spring Boot 1.

Example

```

<project>
  <modelVersion>4.0.0</modelVersion>

  <groupId>com.redhat.fuse</groupId>
  <artifactId>spring-boot-camel</artifactId>
  <version>1.0-SNAPSHOT</version>

  <properties>
    <project.build.sourceEncoding>UTF-8</project.build.sourceEncoding>
    <project.reporting.outputEncoding>UTF-8</project.reporting.outputEncoding>

    <!-- configure the Fuse version you want to use here -->
    <fuse.bom.version>7.7.0.fuse-770012-redhat-00003</fuse.bom.version>

    <!-- maven plugin versions -->
    <maven-compiler-plugin.version>3.7.0</maven-compiler-plugin.version>
    <maven-surefire-plugin.version>2.19.1</maven-surefire-plugin.version>
  </properties>

  <build>
    <defaultGoal>spring-boot:run</defaultGoal>

    <plugins>
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        <artifactId>spring-boot-maven-plugin</artifactId>
        <version>${fuse.bom.version}</version>
        <executions>
          <execution>
            <goals>
              <goal>repackage</goal>
            </goals>
          </execution>
        </executions>
      </plugin>
    </plugins>
  </build>
</project>

```

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        </executions>
    </plugin>
</plugins>
</build>

<repositories>
  <repository>
    <id>redhat-ga-repository</id>
    <url>https://maven.repository.redhat.com/ga</url>
    <releases>
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    </releases>
    <snapshots>
      <enabled>false</enabled>
    </snapshots>
  </repository>
  <repository>
    <id>redhat-ea-repository</id>
    <url>https://maven.repository.redhat.com/earlyaccess/all</url>
    <releases>
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    </releases>
    <snapshots>
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</repositories>

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    </releases>
    <snapshots>
      <enabled>false</enabled>
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    <url>https://maven.repository.redhat.com/earlyaccess/all</url>
    <releases>
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    </releases>
    <snapshots>
      <enabled>false</enabled>
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  </pluginRepository>
</pluginRepositories>
</project>
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