互联网应用开发技术

Web Application Development

第7课
WEB后端-SPRING BOOT

Episode Seven

Spring Boot

陈昊鹏
chen-hp@sjtu.edu.cn

Web Application Development

Overview

- Spring
- Spring Boot
  - Develop Applications with Spring Boot
- Spring Initializr
- Spring Initializr in IntelliJ IDEA

Spring

- Spring makes building web applications fast and hassle-free.
  - By removing much of the boilerplate code and configuration associated with web development, you get a modern web programming model that streamlines the development of server-side HTML applications, REST APIs, and bidirectional, event-based systems.
  - Developer productivity
    - Spring Boot is the starting point of your developer experience, whatever you're building.
    - Spring Boot is designed to get you up and running as quickly as possible, with minimal upfront configuration. With its embedded application servers, you can be serving in seconds.
  - Battle-tested security
    - When it's time to secure your web application, Spring Security supports many industry-standard authentication protocols, including SAML, OAuth, and LDAP.
  - Data access made easy
    - Spring helps developers connect their web applications to a number of data stores. It supports relational and non-relational databases, map-reduce frameworks, and cloud-based data services.

spring

Introduction of Spring Boot

- Spring Boot
  - helps you to create stand-alone, production-grade Spring-based Applications that you can run.
  - We take an opinionated view of the Spring platform and third-party libraries, so that you can get started with minimum fuss.
  - Most Spring Boot applications need very little Spring configuration.

Build Tool	Version
Maven	3.3+
Gradle	6 (6.3 or later). 5.6.x is also supported but in a deprecated form

Name	Servlet Version
Tomcat 9.0	4.0
Jetty 9.4	3.1
Undertow 2.0	4.0

Developing Spring Boot Application

- Before we begin, open a terminal and run the following commands to ensure that you have valid versions of Java and Maven installed:

```
$ java -version java version "1.8.0_102" Java(TM) SE Runtime Environment (build 1.8.0_102-b14) Java HotSpot(TM) 64-Bit Server VM (build 25.102-b14, mixed mode)

$ mvn -v Apache Maven 3.5.4 (1edded0938998edf8bf061f1ceb3cfdeccf443fe; 2018-06-17T14:33:14-04:00) Maven home: /usr/local/Cellar/maven/3.3.9/libexec Java version: 1.8.0_102, vendor: Oracle Corporation
```

Creating the POM


```xml
<?xml version="1.0" encoding="UTF-8"?>
<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 https://maven.apache.org/xsd/maven-4.0.0.xsd">
    <modelVersion>4.0.0</modelVersion>

    <groupId>com.example</groupId>
    <artifactId>myproject</artifactId>
    <version>0.0.1-SNAPSHOT</version>

    <parent>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-starter-parent</artifactId>
        <version>2.4.5</version>
    </parent>

    <description/>
    <developers>
        <developer/>
    </developers>
    <licenses>
        <license/>
    </licenses>
    <scm>
        <url/>
    </scm>
    <url/>

    <!-- Additional lines to be added here... -->

</project>
```

Creating the POM

- To add the necessary dependencies,
  - edit your pom.xml and add the spring-boot-starter-web dependency immediately below the parent section:

```
<dependencies>
    <dependency>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-starter-web</artifactId>
    </dependency>
</dependencies>
```

Writing the Code


```java
import org.springframework.boot.*;
import org.springframework.boot.autoconfigure.*;
import org.springframework.web.bind.annotation.*;

@RestController
@EnableAutoConfiguration
public class Example {

    @RequestMapping("/")
    String home() {
        return "Hello World!";
    }

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

}
```

Writing the Code

- The @RestController and @RequestMapping Annotations
  - The first annotation on our Example class is @RestController.
  - This is known as a *stereotype* annotation.
    - It provides hints for people reading the code and for Spring that the class plays a specific role.
    - In this case, our class is a web @Controller, so Spring considers it when handling incoming web requests.
  - The @RequestMapping annotation provides "routing" information.
    - It tells Spring that any HTTP request with the / path should be mapped to the home method.
  - The @RestController annotation tells Spring to render the resulting string directly back to the caller.

Writing the Code

- The @EnableAutoConfiguration Annotation
  - The second class-level annotation is @EnableAutoConfiguration.
  - This annotation tells Spring Boot to "guess" how you want to configure Spring, based on the jar dependencies that you have added.
  - Since spring-boot-starter-web added Tomcat and Spring MVC, the auto-configuration assumes that you are developing a web application and sets up Spring accordingly.
- Starters and Auto-configuration
  - Auto-configuration is designed to work well with "Starters", but the two concepts are not directly tied.
  - You are free to pick and choose jar dependencies outside of the starters.
  - Spring Boot still does its best to auto-configure your application.

Writing the Code

- The “main” Method
  - The final part of our application is the main method.
  - This is a standard method that follows the Java convention for an application entry point.
  - Our main method delegates to Spring Boot’s SpringApplication class by calling run.
  - SpringApplication bootstraps our application, starting Spring, which, in turn, starts the auto-configured Tomcat web server.
  - We need to pass Example.class as an argument to the run method to tell SpringApplication which is the primary Spring component.
  - The args array is also passed through to expose any command-line arguments.

Writing the Code

- Type mvn spring-boot:run from the root project directory to start the application.
  - You should see output similar to the following:

```
$ mvn spring-boot:run

  .   ____          _            __ _ _
 /\\ / ___'_ __ _ _(_)_ __  __ _ \ \ \ \
( ( )\___ | '_ | '_| | '_ \/ _` | \ \ \ \
 \\/  ___)| |_)| | | | | || (_| |  ) ) ) )
  '  |____| .__|_| |_|_| |_\__, | / / / /
 =========|_|==============|___/=/_/_/_/
 :: Spring Boot ::  (v2.4.5)
....... . . .
....... . . . (log output here)
....... . . .
........ Started Example in 2.222 seconds (JVM running for 6.514)
```

  - If you open a web browser to localhost:8080, you should see the following output:

    `Hello World!`

- Creating an Executable Jar
  - We finish our example by creating a completely self-contained executable jar file that we could run in production.
    - Executable jars (sometimes called “fat jars”) are archives containing your compiled classes along with all of the jar dependencies that your code needs to run.
  - To create an executable jar, we need to add the spring-boot-maven-plugin to our pom.xml.

```
<build>
    <plugins>
        <plugin>
            <groupId>org.springframework.boot</groupId>
            <artifactId>spring-boot-maven-plugin</artifactId>
        </plugin>
    </plugins>
</build>
```

Writing the Code

- Save your pom.xml and run `mvn package` from the command line, as follows:

```
$ mvn package

[INFO] Scanning for projects...
[INFO]
[INFO] ------------------------------------------------------------------------
[INFO] Building myproject 0.0.1-SNAPSHOT
[INFO] ------------------------------------------------------------------------
[INFO] .... ..
[INFO] --- maven-jar-plugin:2.4:jar (default-jar) @ myproject ---
[INFO] Building jar: /Users/developer/example/spring-boot-example/target/myproject-0.0.1-SNAPSHOT.jar
[INFO]
[INFO] --- spring-boot-maven-plugin:2.4.5:repackage (default) @ myproject ---
[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------------------
```

Writing the Code

- To run that application, use the `java -jar` command, as follows:

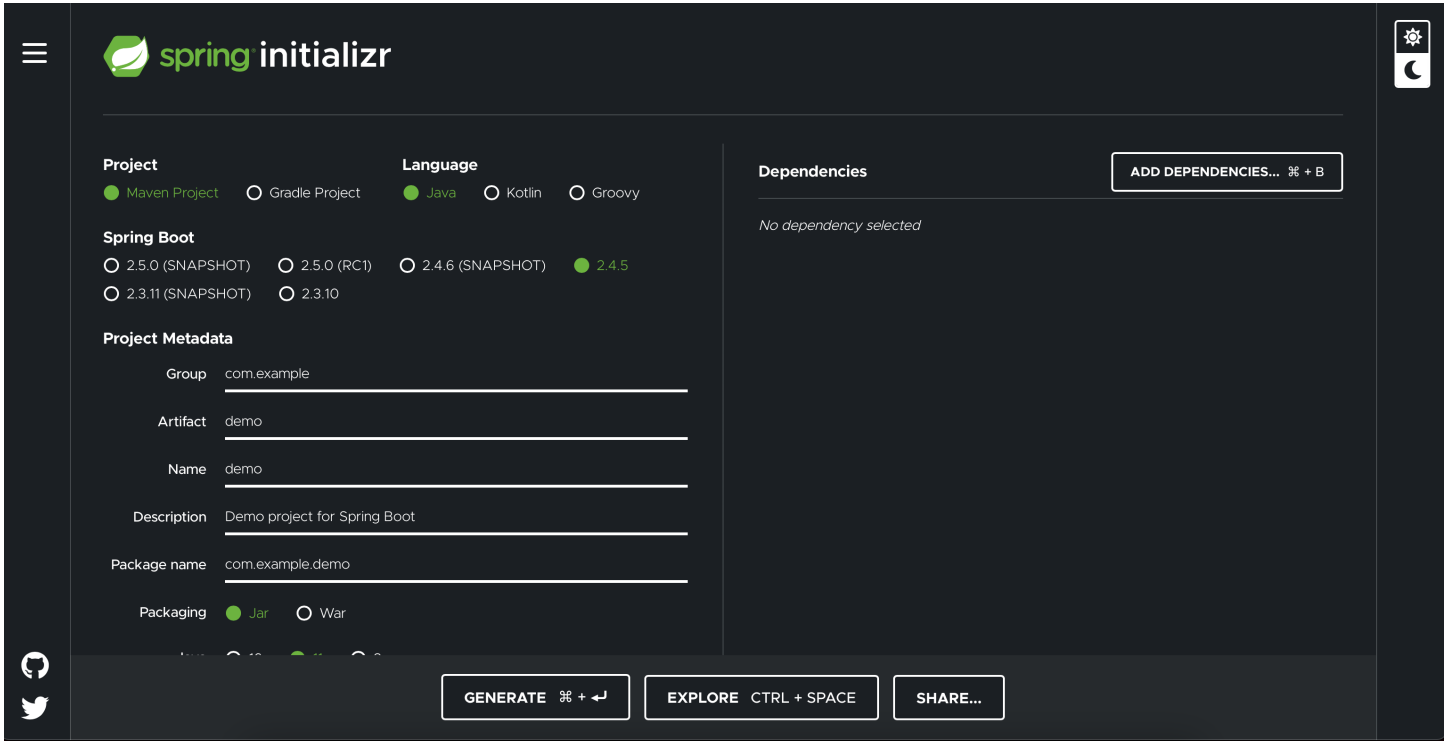
```
$ java -jar target/myproject-0.0.1-SNAPSHOT.jar

  .   ____          _            __ _ _
 /\\ / ___'_ __ _ _(_)_ __  __ _ \ \ \ \
( ( )\___ | '_ | '_| | '_ \/ _` | \ \ \ \
 \\/  ___)| |_)| | | | | || (_| |  ) ) ) )
  '  |____| .__|_| |_|_| |_\__, | / / / /
 =========|_|==============|___/=/_/_/_/
 :: Spring Boot ::  (v2.4.5)
....... . . .
....... . . . (log output here)
....... . . .
........ Started Example in 2.536 seconds (JVM running for 2.864)
```

- As before, to exit the application, press `ctrl-c`.

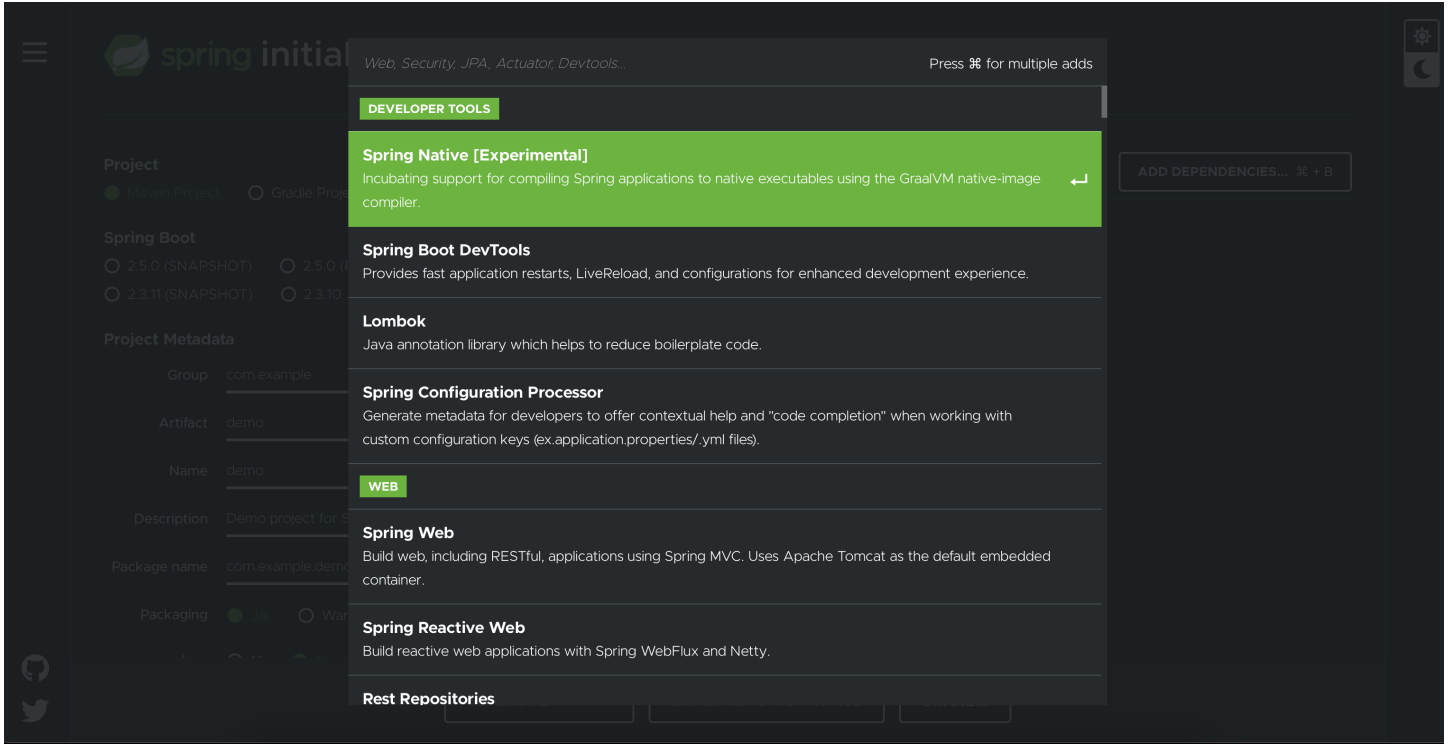
Spring Initializr

- https://start.spring.io

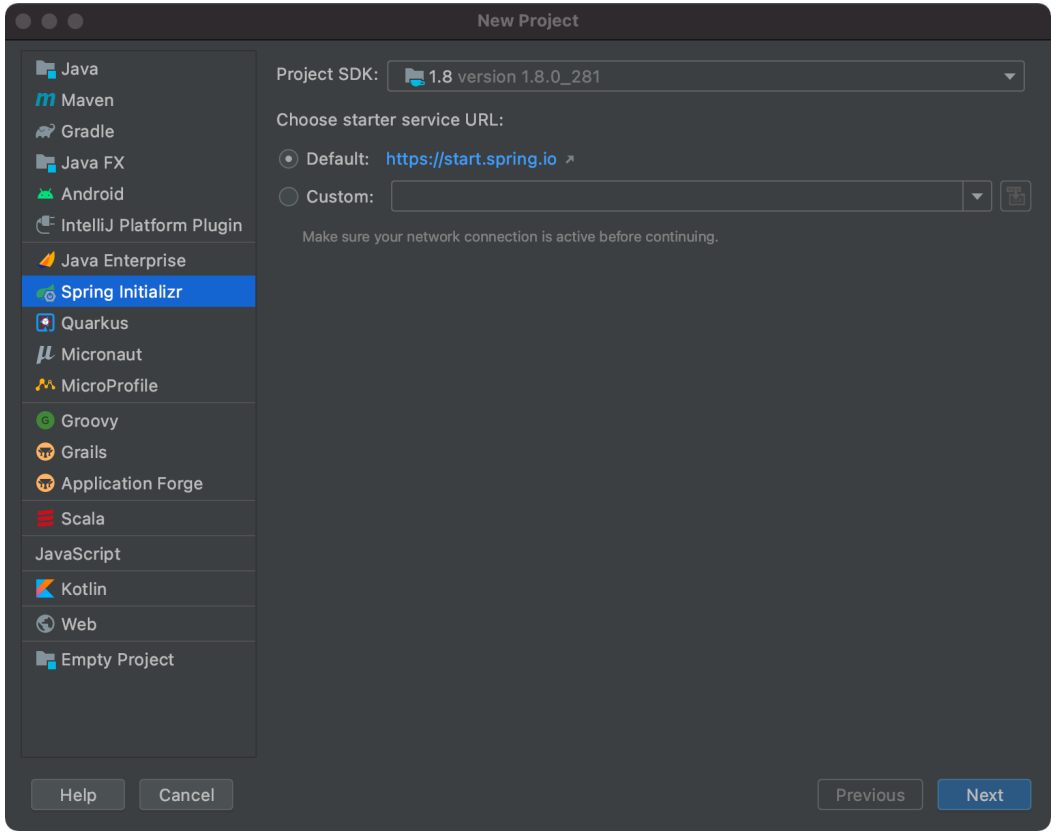


Spring Initializr

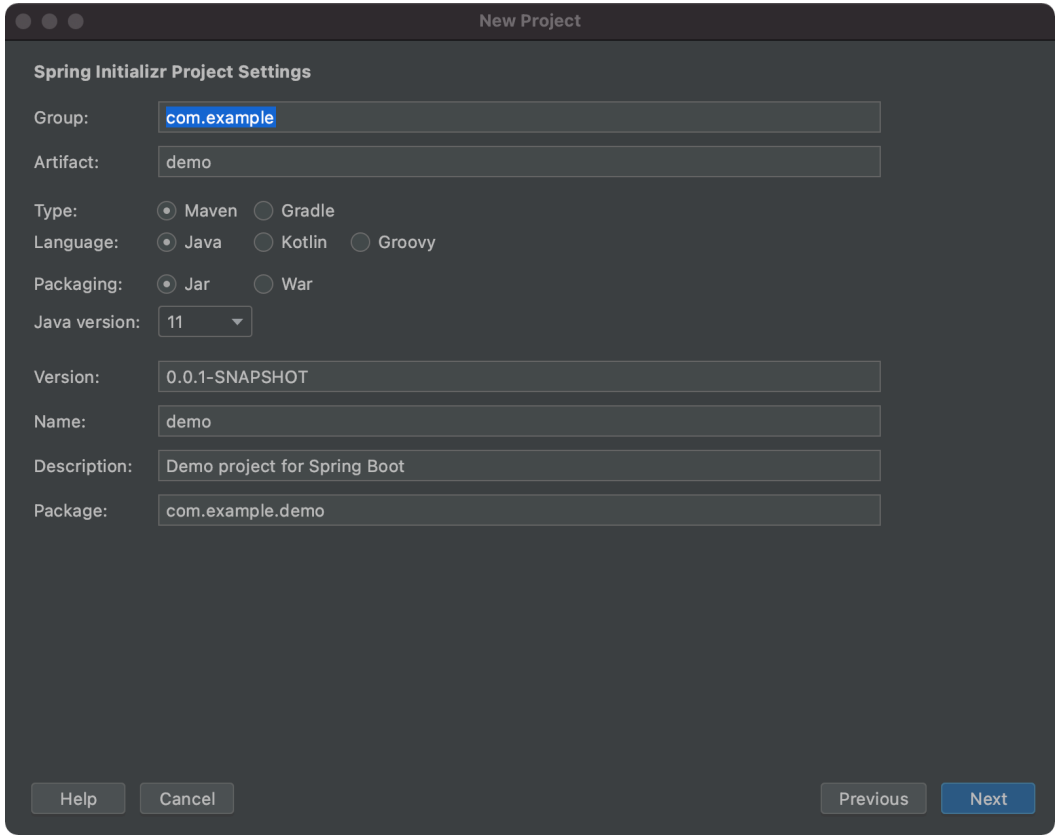
- Add Dependencies



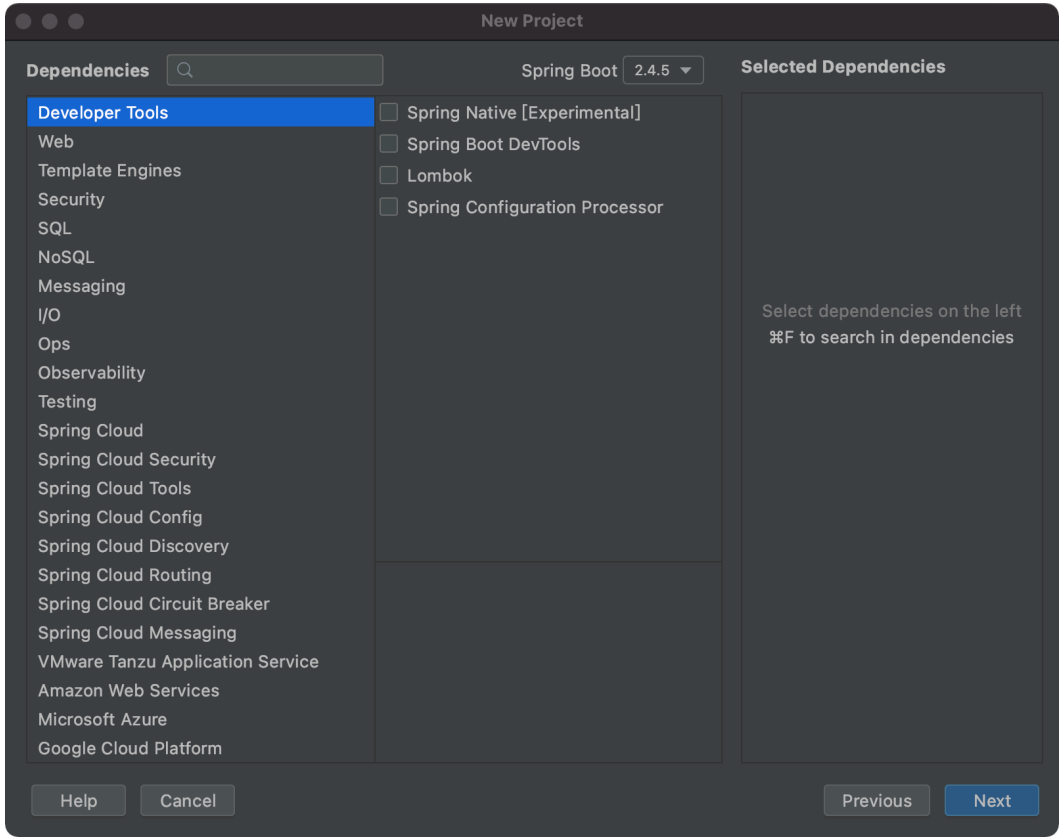
Spring Initializr in IntelliJ IDEA



Spring Initializr in IntelliJ IDEA



Spring Initializr in IntelliJ IDEA



Spring Initializr in IntelliJ IDEA

se122_7_springbootsample – DemoApplication.java

Project
- se122_7_springbootsample ~/IdeaProjects/se122_7
  - .idea
  - .mvn
  - src
    - main
      - java
        - com.example.demo
          - DemoApplication
      - resources
        - static
        - templates
        - application.properties
    - test
  - target
  - .gitignore
  - HELP.md
  - mvnw
  - mvnw.cmd
  - pom.xml
  - se122_7_springbootsample.iml
- External Libraries
- Scratches and Consoles

DemoApplication.java / pom.xml (demo)

```
package com.example.demo;

import ...

@RestController
@SpringBootApplication
public class DemoApplication {

    @RequestMapping("/")
    String home() {
        return "Hello World!";
    }

    public static void main(String[] args) { SpringApplication.run(De

}
```

Maven
- Profiles
  - jboss-ga
  - jdk-13
- demo
  - Lifecycle
  - Plugins
  - Dependencies
    - org.springframework.boot:spring-boot-starter-web:2.4.5
    - org.springframework.boot:spring-boot-starter-test:2.4.5 (test)

Run: DemoApplication

```
2021-04-24 16:47:45.691  INFO 22599 --- [           main] o.s.b.w.embedded.tomcat.TomcatWebServer  : Tomcat started on port(s): 8080 (http) with context path ''
2021-04-24 16:47:45.700  INFO 22599 --- [           main] com.example.demo.DemoApplication         : Started DemoApplication in 1.174 seconds (JVM running for 1.592)
2021-04-24 16:48:00.977  INFO 22599 --- [nio-8080-exec-1] o.a.c.c.C.[Tomcat].[localhost].[/]       : Initializing Spring DispatcherServlet 'dispatcherServlet'
2021-04-24 16:48:00.978  INFO 22599 --- [nio-8080-exec-1] o.s.web.servlet.DispatcherServlet        : Initializing Servlet 'dispatcherServlet'
2021-04-24 16:48:00.979  INFO 22599 --- [nio-8080-exec-1] o.s.web.servlet.DispatcherServlet        : Completed initialization in 1 ms
2021-04-24 16:48:15.593  INFO 22599 --- [extShutdownHook] o.s.s.concurrent.ThreadPoolTaskExecutor  : Shutting down ExecutorService 'applicationTaskExecutor'

Process finished with exit code 130 (interrupted by signal 2: SIGINT)
```

Build completed successfully in 3 sec, 990 ms (2 minutes ago)

Annotated Controllers

- Spring MVC
  - provides an annotation-based programming model where @Controller and @RestController components use annotations to express request mappings, request input, exception handling, and more

```
@Controller
public class HelloController {

  @GetMapping("/hello")
  public String handle(Model model) {
    model.addAttribute("message", "Hello World!");
    return "index";
  }
}
```

Annotated Controllers

- Declaration
  - To enable auto-detection of such @Controller beans, you can add component scanning to your Java configuration

```java
@Configuration
@ComponentScan("org.example.web")
public class WebConfig {
  // ...
}
```

```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"
       xmlns:p="http://www.springframework.org/schema/p"
       xmlns:context="http://www.springframework.org/schema/context"
       xsi:schemaLocation=" http://www.springframework.org/schema/beans
         https://www.springframework.org/schema/beans/spring-beans.xsd
         http://www.springframework.org/schema/context
         https://www.springframework.org/schema/context/spring-context.xsd">
  <context:component-scan base-package="org.example.web"/>
  <!-- ... -->
</beans>
```

Annotated Controllers

- Request Mapping
  - You can use the @RequestMapping annotation to map requests to controllers methods.
  - There are also HTTP method specific shortcut variants of @RequestMapping:
    - @GetMapping
    - @PostMapping
    - @PutMapping
    - @DeleteMapping
    - @PatchMapping

```
@RestController
@RequestMapping("/persons")
class PersonController {

  @GetMapping("/{id}")
  public Person getPerson(@PathVariable Long id) {
    // ...
  }

  @PostMapping
  @ResponseStatus(HttpStatus.CREATED)
  public void add(@RequestBody Person person) {
    // ...
  }
}
```

Annotated Controllers

- Request Mapping
  - URI patterns
    - ? matches one character
    - * matches zero or more characters within a path segment
    - ** match zero or more path segments

```
@GetMapping("/owners/{ownerId}/pets/{petId}")
public Pet findPet(@PathVariable Long ownerId, @PathVariable Long petId) {
  // ...
}
```

```
@Controller @RequestMapping("/owners/{ownerId}")
public class OwnerController {
 @GetMapping("/pets/{petId}")
 public Pet findPet(@PathVariable Long ownerId, @PathVariable Long petId) {
  // ...
 }
}
```

Annotated Controllers

- @RequestParam
  - You can use the @RequestParam annotation to bind Servlet request parameters (that is, query parameters or form data) to a method argument in a controller.

```java
@Controller
@RequestMapping("/pets")
public class EditPetForm {
  // ...
  @GetMapping
  public String setupForm(@RequestParam("petId") int petId, Model model) {
    Pet pet = this.clinic.loadPet(petId);
    model.addAttribute("pet", pet);
    return "petForm";
  }
  // ...
}
```

References

- Spring Web Application
  - https://spring.io/web-applications
- Spring Boot Getting Started
  - https://docs.spring.io/spring-boot/docs/current/reference/html/getting-started.html#getting-started
- Spring Initializr
  - https://start.spring.io
- Spring Annotated Controllers
  - https://docs.spring.io/spring-framework/docs/current/reference/html/web.html#mvc-controller

- *Web开发技术*
- *Web Application Development*

Thank You!