SpringBoot基础

学习目标：

1. 能够理解Spring的优缺点
2. 能够理解SpringBoot的特点
3. 能够理解SpringBoot的核心功能
4. 能够搭建SpringBoot的环境
5. 能够完成application.properties配置文件的配置
6. 能够完成application.yml配置文件的配置
7. 能够使用SpringBoot集成Mybatis
8. 能够使用SpringBoot集成Junit
9. 能够使用SpringBoot集成SpringData JPA

一、SpringBoot简介

1.1 原有Spring优缺点分析

1.1.1 Spring的优点分析

Spring是Java企业版（Java Enterprise Edition，JEE，也称J2EE）的轻量级代替品。无需开发重量级的Enterprise JavaBean（EJB），Spring为企业级Java开发提供了一种相对简单的方法，通过依赖注入和面向切面编程，用简单的Java对象（Plain Old Java Object，POJO）实现了EJB的功能。

1.1.2 Spring的缺点分析

虽然Spring的组件代码是轻量级的，但它的配置却是重量级的。一开始，Spring用XML配置，而且是很多XML配置。Spring 2.5引入了基于注解的组件扫描，这消除了大量针对应用程序自身组件的显式XML配置。Spring 3.0引入了基于Java的配置，这是一种类型安全的可重构配置方式，可以代替XML。

所有这些配置都代表了开发时的损耗。因为在思考Spring特性配置和解决业务问题之间需要进行思维切换，所以编写配置挤占了编写应用程序逻辑的时间。和所有框架一样，Spring实用，但与此同时它要求的回报也不少。

除此之外，项目的依赖管理也是一件耗时耗力的事情。在环境搭建时，需要分析要导入哪些库的坐标，而且还需要分析导入与之有依赖关系的其他库的坐标，一旦选错了依赖的版本，随之而来的不兼容问题就会严重阻碍项目的开发进度。

1.2 SpringBoot的概述

1.2.1 SpringBoot解决上述Spring的缺点

SpringBoot对上述Spring的缺点进行的改善和优化，基于约定优于配置的思想，可以让开发人员不必在配置与逻辑业务之间进行思维的切换，全身心的投入到逻辑业务的代码编写中，从而大大提高了开发的效率，一定程度上缩短了项目周期。

1.2.2 SpringBoot的特点

- 为基于Spring的开发提供更快的入门体验
- 开箱即用，没有代码生成，也无需XML配置。同时也可以修改默认值来满足特定的需求
- 提供了一些大型项目中常见的非功能性特性，如嵌入式服务器、安全、指标，健康检测、外部配置等
- SpringBoot不是对Spring功能上的增强，而是提供了一种快速使用Spring的方式

1.2.3 SpringBoot的核心功能

- 起步依赖

  起步依赖本质上是一个Maven项目对象模型（Project Object Model，POM），定义了对其他库的传递依赖，这些东西加在一起即支持某项功能。

  简单的说，起步依赖就是将具备某种功能的坐标打包到一起，并提供一些默认的功能。

- 自动配置

  Spring Boot的自动配置是一个运行时（更准确地说，是应用程序启动时）的过程，考虑了众多因素，才决定Spring配置应该用哪个，不该用哪个。该过程是Spring自动完成的。

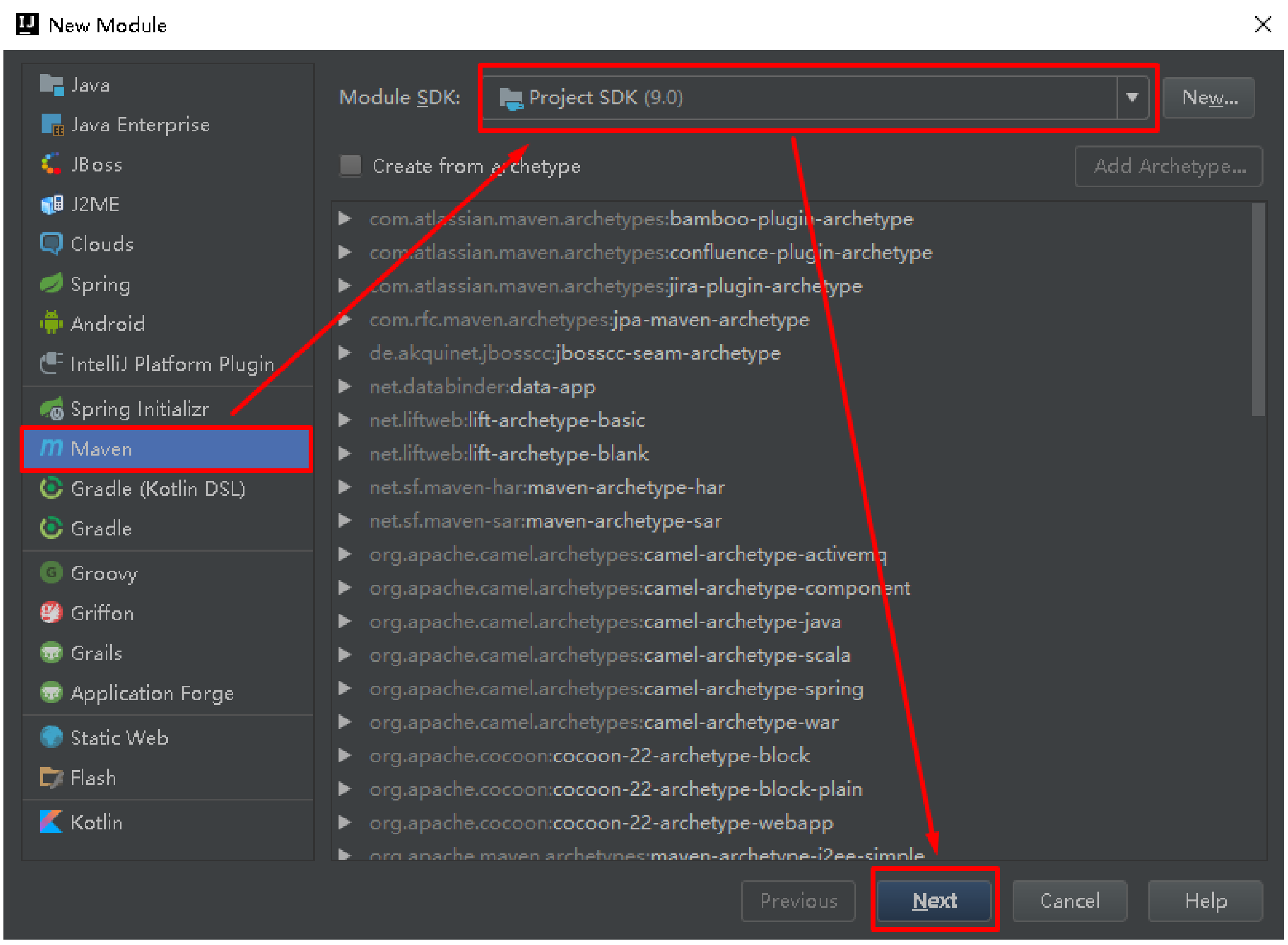
注意：起步依赖和自动配置的原理剖析会在第三章《SpringBoot原理分析》进行详细讲解

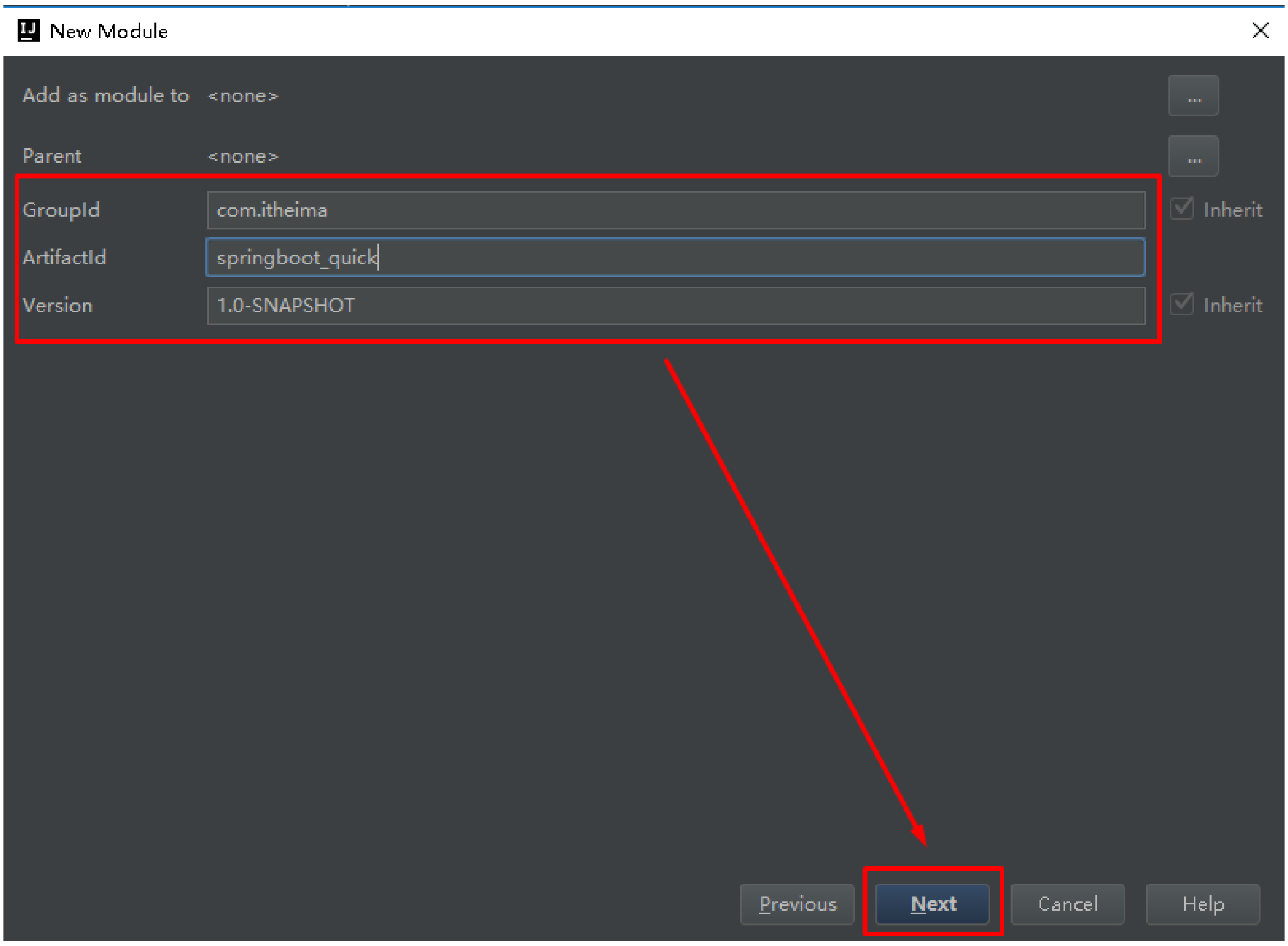
二、SpringBoot快速入门

2.1 代码实现

2.1.1 创建Maven工程

使用idea工具创建一个maven工程，该工程为普通的java工程即可


New Module
Java
Java Enterprise
JBoss
J2ME
Clouds
Spring
Android
IntelliJ Platform Plugin
Spring Initializr
Maven
Gradle (Kotlin DSL)
Gradle
Groovy
Griffon
Grails
Application Forge
Static Web
Flash
Kotlin
Module SDK:
Project SDK (9.0)
New...
Create from archetype
Add Archetype...
com.atlassian.maven.archetypes:bamboo-plugin-archetype
com.atlassian.maven.archetypes:confluence-plugin-archetype
com.atlassian.maven.archetypes:jira-plugin-archetype
com.rfc.maven.archetypes:jpa-maven-archetype
de.akquinet.jbosscc:jbosscc-seam-archetype
net.databinder:data-app
net.liftweb:lift-archetype-basic
net.liftweb:lift-archetype-blank
net.sf.maven-har:maven-archetype-har
net.sf.maven-sar:maven-archetype-sar
org.apache.camel.archetypes:camel-archetype-activemq
org.apache.camel.archetypes:camel-archetype-component
org.apache.camel.archetypes:camel-archetype-java
org.apache.camel.archetypes:camel-archetype-scala
org.apache.camel.archetypes:camel-archetype-spring
org.apache.camel.archetypes:camel-archetype-war
org.apache.cocoon:cocoon-22-archetype-block
org.apache.cocoon:cocoon-22-archetype-block-plain
org.apache.cocoon:cocoon-22-archetype-webapp
org.apache.maven.archetypes:maven-archetype-j2ee-simple
Previous
Next
Cancel
Help



New Module

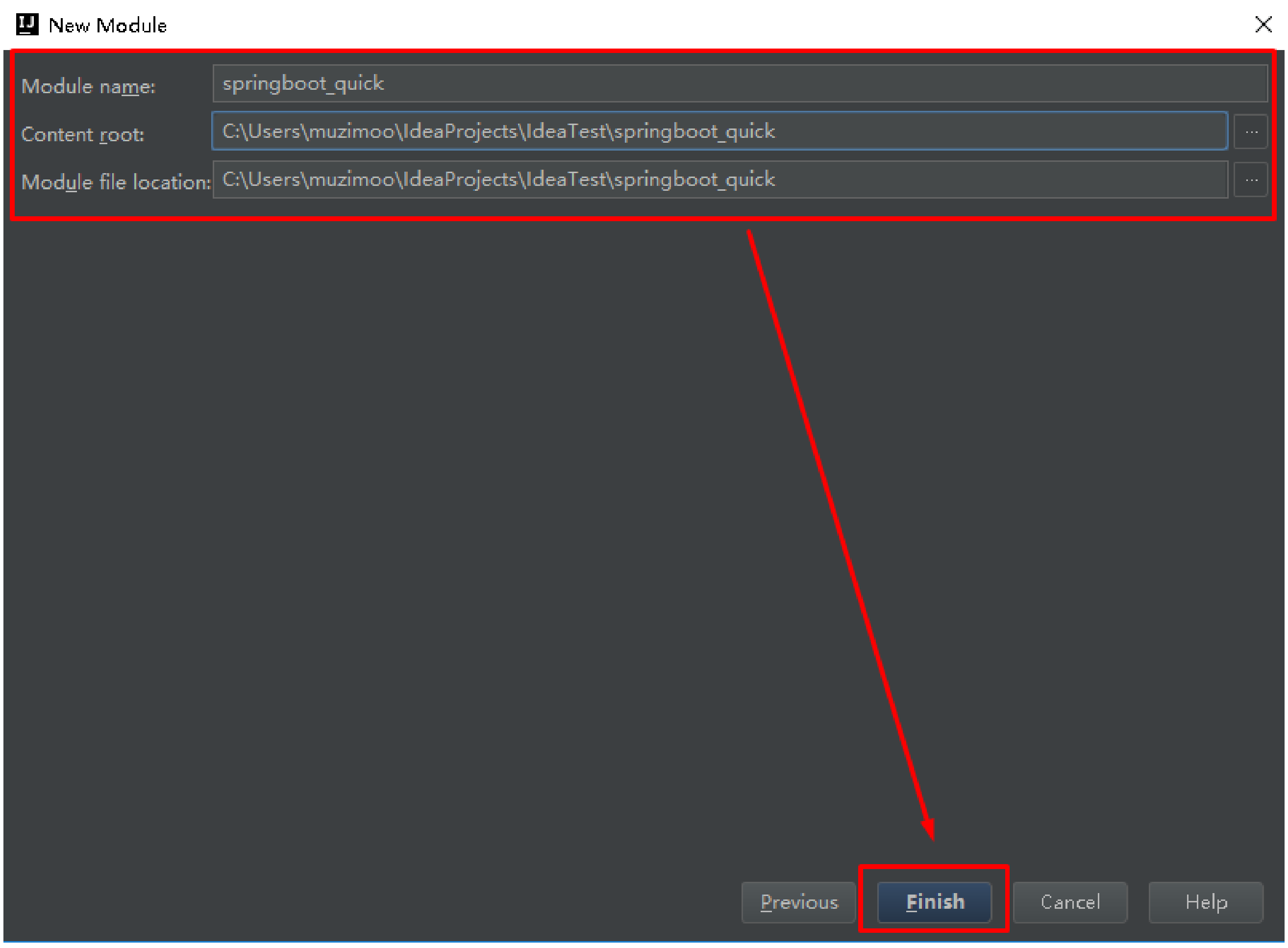
Add as module to <none>

Parent <none>

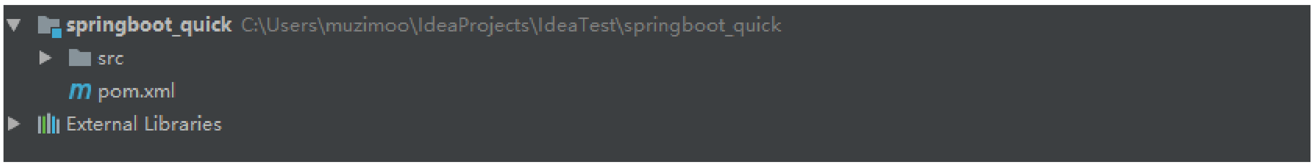
GroupId com.itheima ✓ Inherit

ArtifactId springboot_quick

Version 1.0-SNAPSHOT ✓ Inherit



Module name: springboot_quick
Content root: C:\Users\muzimoo\IdeaProjects\IdeaTest\springboot_quick
Module file location: C:\Users\muzimoo\IdeaProjects\IdeaTest\springboot_quick



```
springboot_quick C:\Users\muzimoo\IdeaProjects\IdeaTest\springboot_quick
    src
    pom.xml
External Libraries
```

2.1.2 添加SpringBoot的起步依赖

SpringBoot要求，项目要继承SpringBoot的起步依赖spring-boot-starter-parent

```
<parent>
    <groupId>org.springframework.boot</groupId>
    <artifactId>spring-boot-starter-parent</artifactId>
    <version>2.0.1.RELEASE</version>
</parent>
```

SpringBoot要集成SpringMVC进行Controller的开发，所以项目要导入web的启动依赖

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

2.1.3 编写SpringBoot引导类

要通过SpringBoot提供的引导类起步SpringBoot才可以进行访问

```java
package com.itheima;

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

@SpringBootApplication
public class MySpringBootApplication {

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

}
```

2.1.4 编写Controller

在引导类MySpringBootApplication同级包或者子级包中创建QuickStartController

```java
package com.itheima.controller;

import org.springframework.stereotype.Controller;
import org.springframework.web.bind.annotation.RequestMapping;
import org.springframework.web.bind.annotation.ResponseBody;

@Controller
public class QuickStartController {

    @RequestMapping("/quick")
    @ResponseBody
    public String quick(){
        return "springboot 访问成功!";
    }

}
```

2.1.5 测试

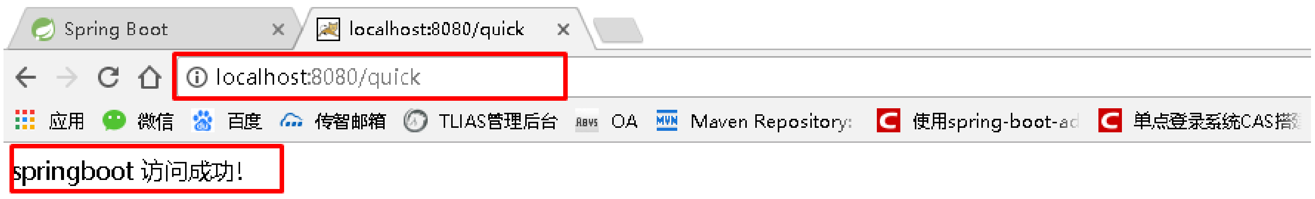
执行SpringBoot起步类的主方法，控制台打印日志如下：

```
.   ____          _            __ _ _
 /\\ / ___'_ __ _ _(_)_ __  __ _ \ \ \ \
( ( )\___ | '_ | '_| | '_ \/ _` | \ \ \ \
 \\/  ___)| |_)| | | | | || (_| |  ) ) ) )
  '  |____| .__|_| |_|_| |_\__, | / / / /
 =========|_|==============|___/=/_/_/_/
 :: Spring Boot ::        (v2.0.1.RELEASE)

2018-05-08 14:29:59.714  INFO 5672 --- [           main] com.itheima.MySpringBootApplication      : Starting MySpringBootApplication on DESKTOP-RRUNFUH with PID 5672 (C:\Users\muzimoo\IdeaProjects\IdeaTest\springboot_quick\target\classes started by muzimoo in C:\Users\muzimoo\IdeaProjects\IdeaTest)
... ... ...
o.s.w.s.handler.SimpleUrlHandlerMapping  : Mapped URL path [/**] onto handler of type [class org.springframework.web.servlet.resource.ResourceHttpRequestHandler]
2018-05-08 14:30:03.126  INFO 5672 --- [           main] o.s.j.e.a.AnnotationMBeanExporter        : Registering beans for JMX exposure on startup
2018-05-08 14:30:03.196  INFO 5672 --- [           main] o.s.b.w.embedded.tomcat.TomcatWebServer  : Tomcat started on port(s): 8080 (http) with context path ''
2018-05-08 14:30:03.206  INFO 5672 --- [           main] com.itheima.MySpringBootApplication      : Started MySpringBootApplication in 4.252 seconds (JVM running for 5.583)
```

通过日志发现，Tomcat started on port(s): 8080 (http) with context path ''

tomcat已经起步，端口监听8080，web应用的虚拟工程名称为空

打开浏览器访问url地址为：http://localhost:8080/quick



springboot 访问成功!

2.2 快速入门解析

2.2.2 SpringBoot代码解析

- @SpringBootApplication：标注SpringBoot的启动类，该注解具备多种功能（后面详细剖析）
- SpringApplication.run(MySpringBootApplication.class) 代表运行SpringBoot的启动类，参数为SpringBoot启动类的字节码对象

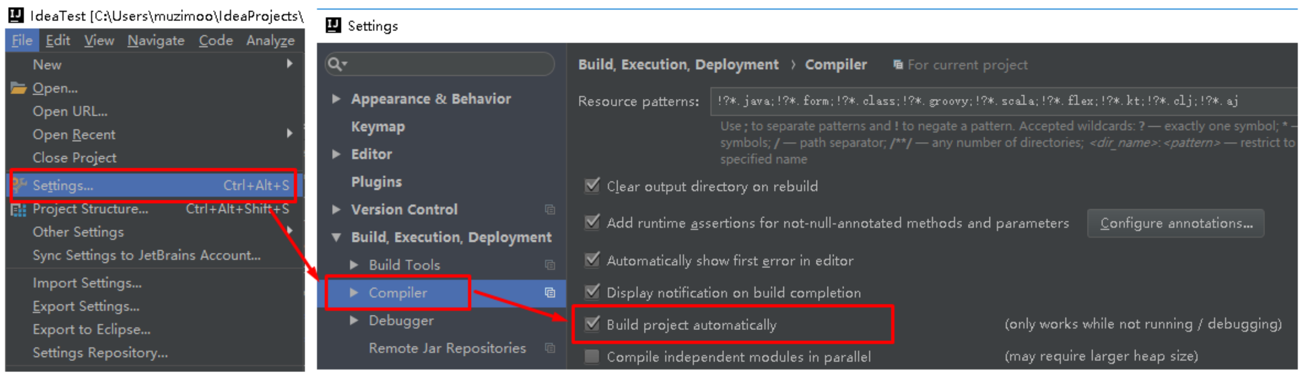
2.2.3 SpringBoot工程热部署

我们在开发中反复修改类、页面等资源，每次修改后都是需要重新启动才生效，这样每次启动都很麻烦，浪费了大量的时间，我们可以在修改代码后不重启就能生效，在 pom.xml 中添加如下配置就可以实现这样的功能，我们称之为热部署。

```xml
<!--热部署配置-->
<dependency>
    <groupId>org.springframework.boot</groupId>
    <artifactId>spring-boot-devtools</artifactId>
</dependency>
```

注意：IDEA进行SpringBoot热部署失败原因

出现这种情况，并不是热部署配置问题，其根本原因是因为Intellij IEDA默认情况下不会自动编译，需要对IDEA进行自动编译的设置，如下：



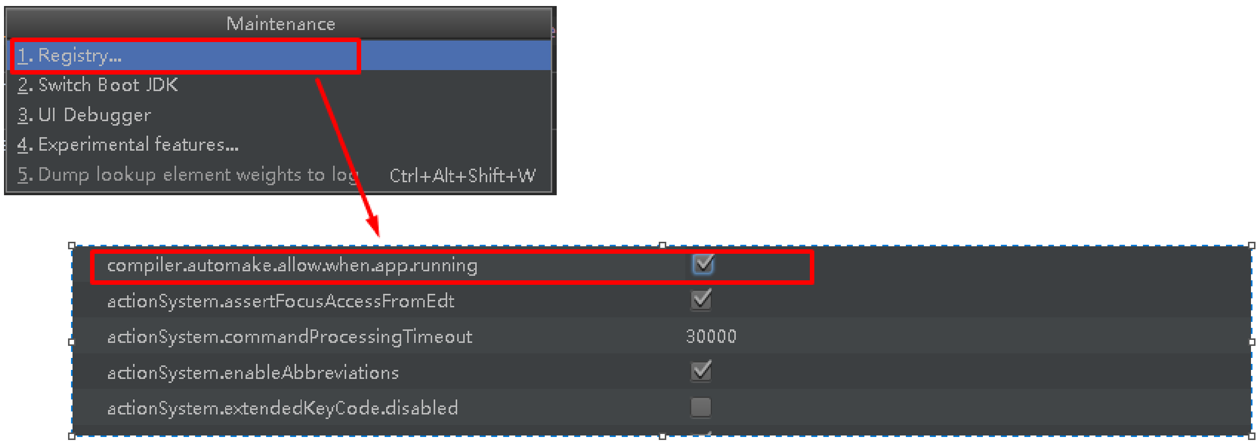
Build, Execution, Deployment › Compiler   For current project

Resource patterns: !?*.java;!?*.form;!?*.class;!?*.groovy;!?*.scala;!?*.flex;!?*.kt;!?*.clj;!?*.aj

Use ; to separate patterns and ! to negate a pattern. Accepted wildcards: ? — exactly one symbol; * — symbols; / — path separator; /**/ — any number of directories; <dir_name>:<pattern> — restrict to specified name

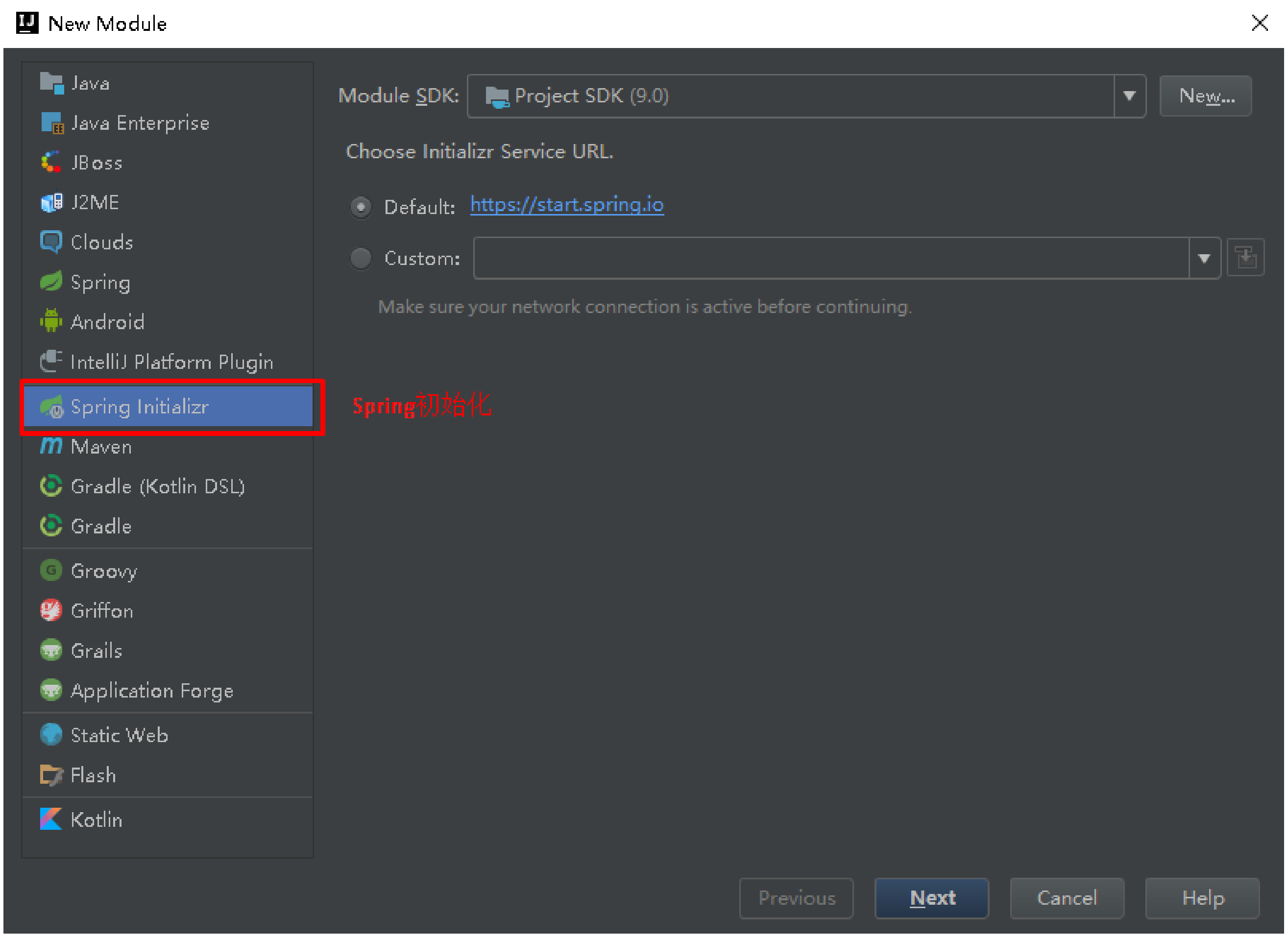
- [✓] Clear output directory on rebuild
- [✓] Add runtime assertions for not-null-annotated methods and parameters
- [✓] Automatically show first error in editor
- [✓] Display notification on build completion
- [✓] Build project automatically (only works while not running / debugging)
- [ ] Compile independent modules in parallel (may require larger heap size)

然后 Shift+Ctrl+Alt+/，选择Registry


Maintenance
1. Registry...
2. Switch Boot JDK
3. UI Debugger
4. Experimental features...
5. Dump lookup element weights to log Ctrl+Alt+Shift+W

compiler.automake.allow.when.app.running	✓
actionSystem.assertFocusAccessFromEdt	✓
actionSystem.commandProcessingTimeout	30000
actionSystem.enableAbbreviations	✓
actionSystem.extendedKeyCode.disabled	

2.2.4 使用idea快速创建SpringBoot项目



Module SDK: Project SDK (9.0)

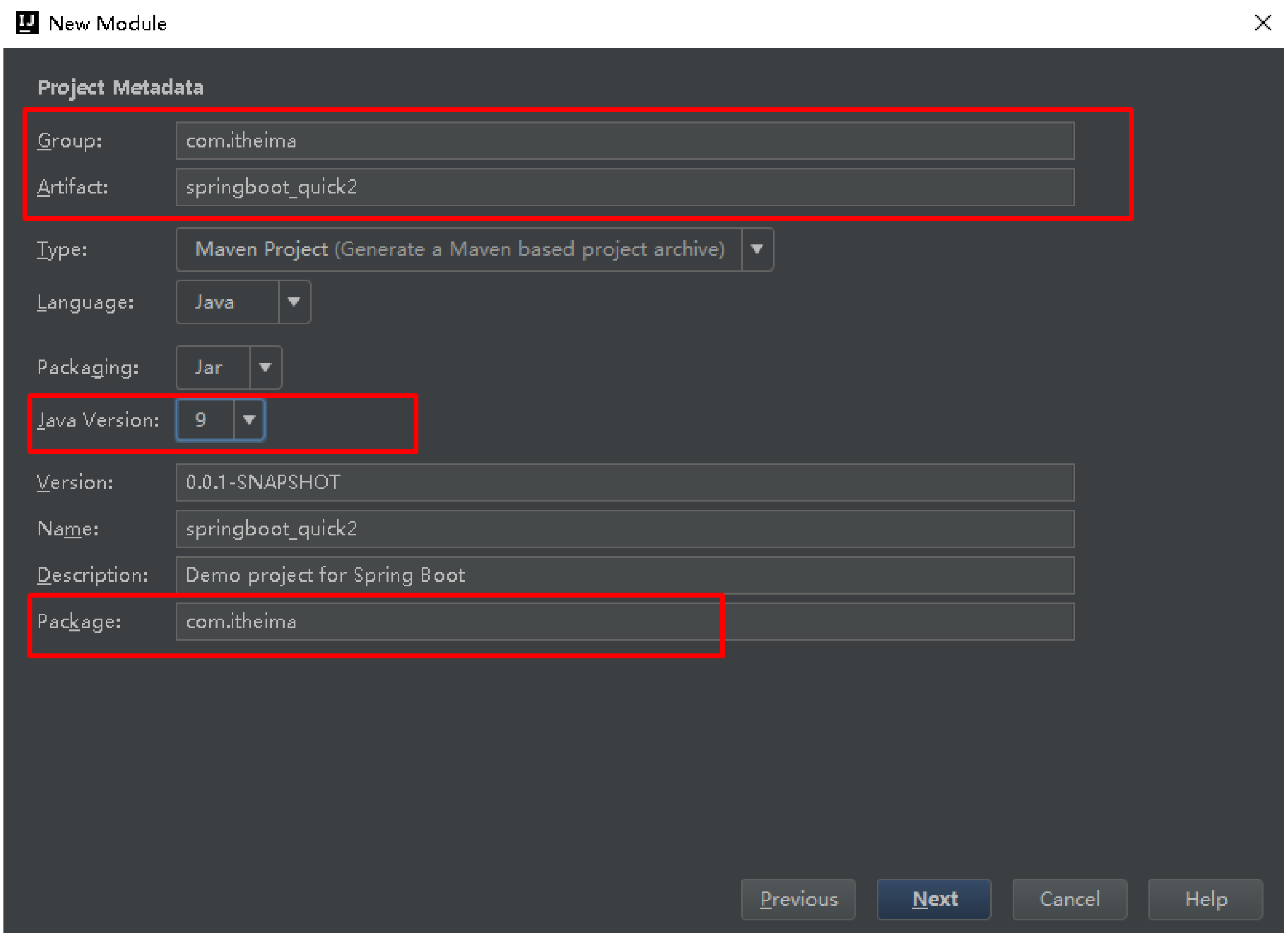
Choose Initializr Service URL.

Default: https://start.spring.io

Custom:

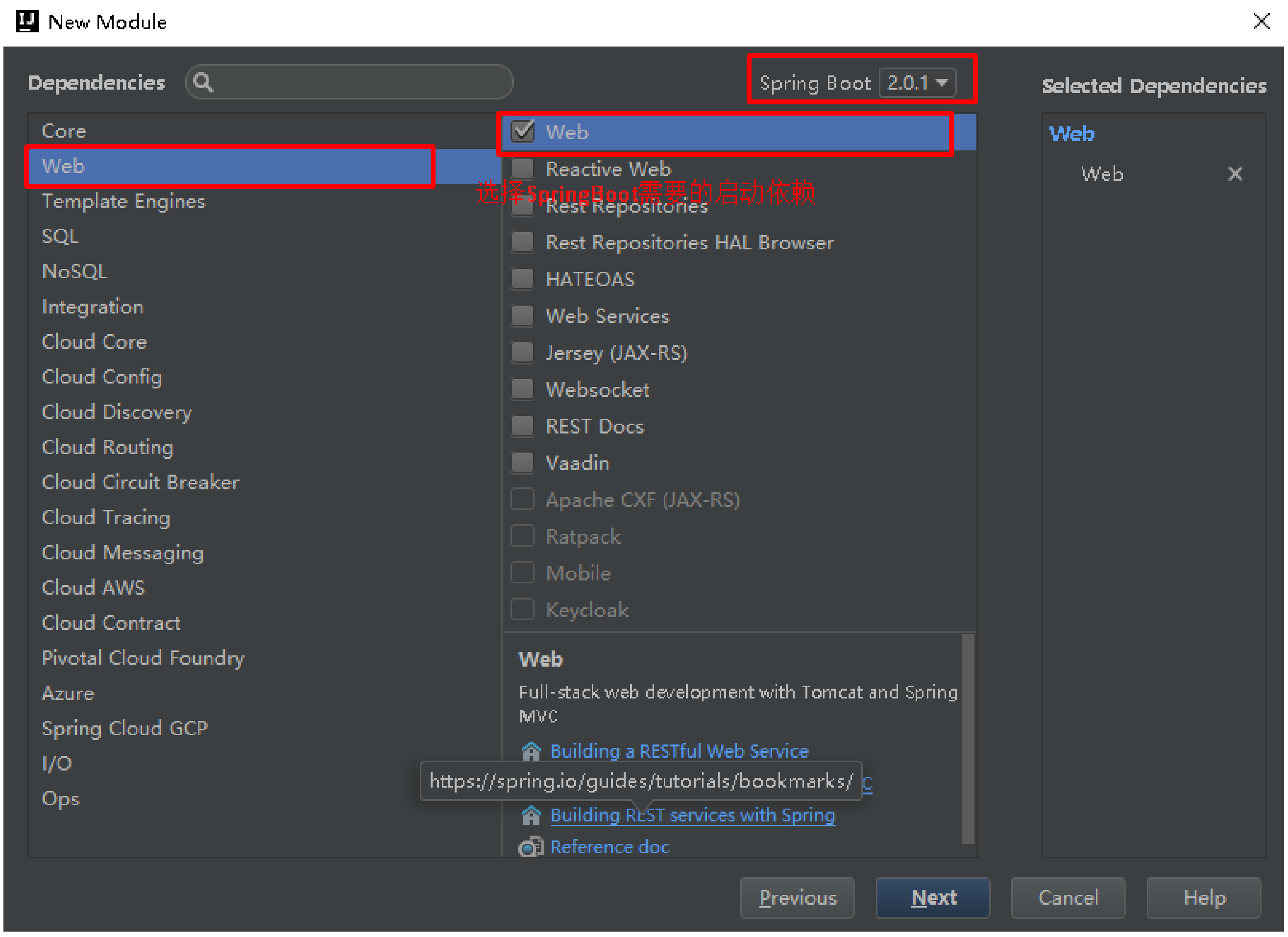
Make sure your network connection is active before continuing.

Spring初始化



Project Metadata

Group:	com.itheima
Artifact:	springboot_quick2
Type:	Maven Project (Generate a Maven based project archive)
Language:	Java
Packaging:	Jar
Java Version:	9
Version:	0.0.1-SNAPSHOT
Name:	springboot_quick2
Description:	Demo project for Spring Boot
Package:	com.itheima


New Module

Dependencies

Spring Boot 2.0.1

选择SpringBoot需要的启动依赖

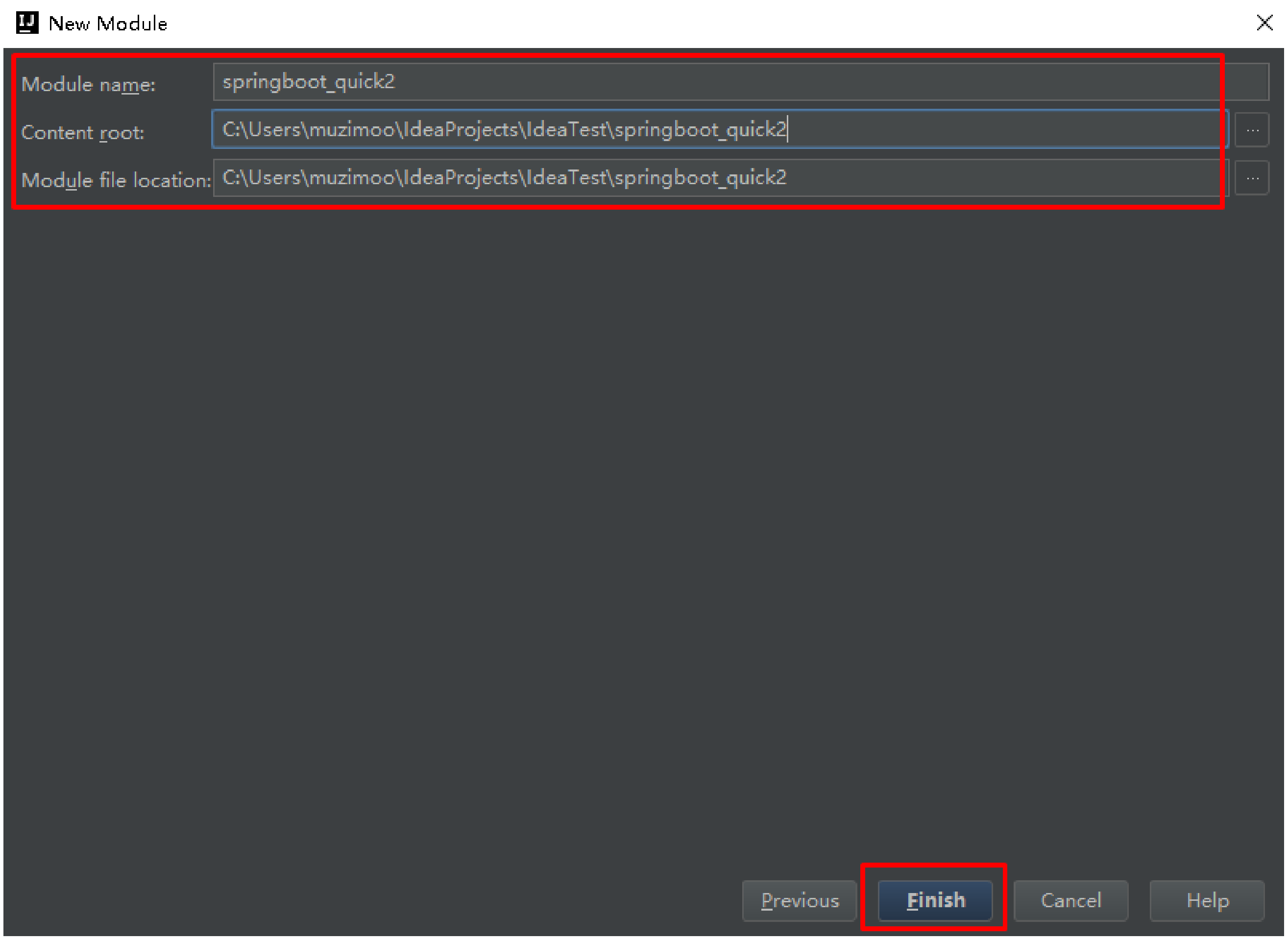
[✓ Web]

Selected Dependencies: Web

Web

Full-stack web development with Tomcat and Spring MVC

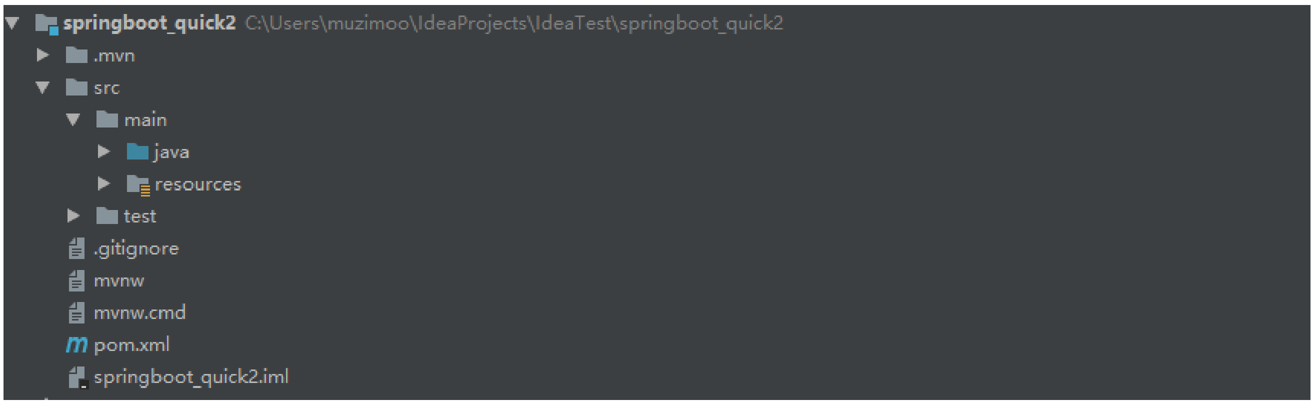
https://spring.io/guides/tutorials/bookmarks/


New Module

Module name: springboot_quick2

Content root: C:\Users\muzimoo\IdeaProjects\IdeaTest\springboot_quick2

Module file location: C:\Users\muzimoo\IdeaProjects\IdeaTest\springboot_quick2



```
springboot_quick2  C:\Users\muzimoo\IdeaProjects\IdeaTest\springboot_quick2
  .mvn
  src
    main
      java
      resources
    test
  .gitignore
  mvnw
  mvnw.cmd
  pom.xml
  springboot_quick2.iml
```

通过idea快速创建的SpringBoot项目的pom.xml中已经导入了我们选择的web的起步依赖的坐标

```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
http://maven.apache.org/xsd/maven-4.0.0.xsd">
    <modelVersion>4.0.0</modelVersion>

    <groupId>com.itheima</groupId>
    <artifactId>springboot_quick2</artifactId>
    <version>0.0.1-SNAPSHOT</version>
    <packaging>jar</packaging>

    <name>springboot_quick2</name>
    <description>Demo project for Spring Boot</description>

    <parent>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-starter-parent</artifactId>
        <version>2.0.1.RELEASE</version>
        <relativePath/> <!-- lookup parent from repository -->
    </parent>

    <properties>
        <project.build.sourceEncoding>UTF-8</project.build.sourceEncoding>
        <project.reporting.outputEncoding>UTF-8</project.reporting.outputEncoding>
        <java.version>9</java.version>
    </properties>

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

        <dependency>
            <groupId>org.springframework.boot</groupId>
            <artifactId>spring-boot-starter-test</artifactId>
            <scope>test</scope>
        </dependency>
    </dependencies>

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


</project>

```

可以使用快速入门的方式创建Controller进行访问，此处不再赘述

三、SpringBoot原理分析

3.1 起步依赖原理分析

3.1.1 分析spring-boot-starter-parent

按住Ctrl点击pom.xml中的spring-boot-starter-parent，跳转到了spring-boot-starter-parent的pom.xml，xml配置如下（只摘抄了部分重点配置）：

```
<parent>
  <groupId>org.springframework.boot</groupId>
  <artifactId>spring-boot-dependencies</artifactId>
  <version>2.0.1.RELEASE</version>
  <relativePath>../../spring-boot-dependencies</relativePath>
</parent>
```

按住Ctrl点击pom.xml中的spring-boot-starter-dependencies，跳转到了spring-boot-starter-dependencies的pom.xml，xml配置如下（只摘抄了部分重点配置）：

```
<properties>
    <activemq.version>5.15.3</activemq.version>
    <antlr2.version>2.7.7</antlr2.version>
    <appengine-sdk.version>1.9.63</appengine-sdk.version>
    <artemis.version>2.4.0</artemis.version>
    <aspectj.version>1.8.13</aspectj.version>
    <assertj.version>3.9.1</assertj.version>
    <atomikos.version>4.0.6</atomikos.version>
    <bitronix.version>2.1.4</bitronix.version>

    <build-helper-maven-plugin.version>3.0.0</build-helper-maven-plugin.version>
    <byte-buddy.version>1.7.11</byte-buddy.version>
    ... ... ...
</properties>
<dependencyManagement>
    <dependencies>
        <dependency>
            <groupId>org.springframework.boot</groupId>
            <artifactId>spring-boot</artifactId>
            <version>2.0.1.RELEASE</version>
        </dependency>
        <dependency>
            <groupId>org.springframework.boot</groupId>
            <artifactId>spring-boot-test</artifactId>
            <version>2.0.1.RELEASE</version>
        </dependency>
        ... ... ...
    </dependencies>
</dependencyManagement>
<build>
    <pluginManagement>
        <plugins>
            <plugin>
                <groupId>org.jetbrains.kotlin</groupId>
                <artifactId>kotlin-maven-plugin</artifactId>
                <version>${kotlin.version}</version>
            </plugin>
            <plugin>
                <groupId>org.jooq</groupId>
                <artifactId>jooq-codegen-maven</artifactId>
                <version>${jooq.version}</version>
            </plugin>
            <plugin>
                <groupId>org.springframework.boot</groupId>
                <artifactId>spring-boot-maven-plugin</artifactId>
                <version>2.0.1.RELEASE</version>
            </plugin>
            ... ... ...
        </plugins>
    </pluginManagement>
</build>
```

从上面的spring-boot-starter-dependencies的pom.xml中我们可以发现，一部分坐标的版本、依赖管理、插件管理已经定义好，所以我们的SpringBoot工程继承spring-boot-starter-parent后已经具备版本锁定等配置了。所以起步依赖的作用就是进行依赖的传递。

3.1.2 分析spring-boot-starter-web

按住Ctrl点击pom.xml中的spring-boot-starter-web，跳转到了spring-boot-starter-web的pom.xml，xml配置如下（只摘抄了部分重点配置）：

```
<?xml version="1.0" encoding="UTF-8"?>
<project xsi:schemaLocation="http://maven.apache.org/POM/4.0.0
```

```xml
http://maven.apache.org/xsd/maven-4.0.0.xsd"
xmlns="http://maven.apache.org/POM/4.0.0"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <modelVersion>4.0.0</modelVersion>
    <parent>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-starters</artifactId>
        <version>2.0.1.RELEASE</version>
    </parent>
    <groupId>org.springframework.boot</groupId>
    <artifactId>spring-boot-starter-web</artifactId>
    <version>2.0.1.RELEASE</version>
    <name>Spring Boot Web Starter</name>

    <dependencies>
        <dependency>
            <groupId>org.springframework.boot</groupId>
            <artifactId>spring-boot-starter</artifactId>
            <version>2.0.1.RELEASE</version>
            <scope>compile</scope>
        </dependency>
        <dependency>
            <groupId>org.springframework.boot</groupId>
            <artifactId>spring-boot-starter-json</artifactId>
            <version>2.0.1.RELEASE</version>
            <scope>compile</scope>
        </dependency>
        <dependency>
            <groupId>org.springframework.boot</groupId>
            <artifactId>spring-boot-starter-tomcat</artifactId>
            <version>2.0.1.RELEASE</version>
            <scope>compile</scope>
        </dependency>
        <dependency>
            <groupId>org.hibernate.validator</groupId>
            <artifactId>hibernate-validator</artifactId>
            <version>6.0.9.Final</version>
            <scope>compile</scope>
        </dependency>
        <dependency>
            <groupId>org.springframework</groupId>
            <artifactId>spring-web</artifactId>
            <version>5.0.5.RELEASE</version>
            <scope>compile</scope>
        </dependency>
        <dependency>
            <groupId>org.springframework</groupId>
            <artifactId>spring-webmvc</artifactId>
            <version>5.0.5.RELEASE</version>
            <scope>compile</scope>
        </dependency>
    </dependencies>

</project>
```

从上面的spring-boot-starter-web的pom.xml中我们可以发现，spring-boot-starter-web就是将web开发要使用的spring-web、spring-webmvc等坐标进行了“打包”，这样我们的工程只要引入spring-boot-starter-web起步依赖的坐标就可以进行web开发了，同样体现了依赖传递的作用。

3.2 自动配置原理解析

按住Ctrl点击查看启动类MySpringBootApplication上的注解@SpringBootApplication

```java
@SpringBootApplication
public class MySpringBootApplication {
    public static void main(String[] args) {
        SpringApplication.run(MySpringBootApplication.class);
    }
}
```

注解@SpringBootApplication的源码

```java
@Target(ElementType.TYPE)
@Retention(RetentionPolicy.RUNTIME)
@Documented
@Inherited
@SpringBootConfiguration
@EnableAutoConfiguration
@ComponentScan(excludeFilters = {
        @Filter(type = FilterType.CUSTOM, classes = TypeExcludeFilter.class),
        @Filter(type = FilterType.CUSTOM, classes = AutoConfigurationExcludeFilter.class) })
public @interface SpringBootApplication {

    /**
     * Exclude specific auto-configuration classes such that they will never be applied.
     * @return the classes to exclude
     */
    @AliasFor(annotation = EnableAutoConfiguration.class)
    Class<?>[] exclude() default {};

    ... ... ...

}
```

其中，

@SpringBootConfiguration：等同与@Configuration，既标注该类是Spring的一个配置类

@EnableAutoConfiguration：SpringBoot自动配置功能开启

按住Ctrl点击查看注解@EnableAutoConfiguration

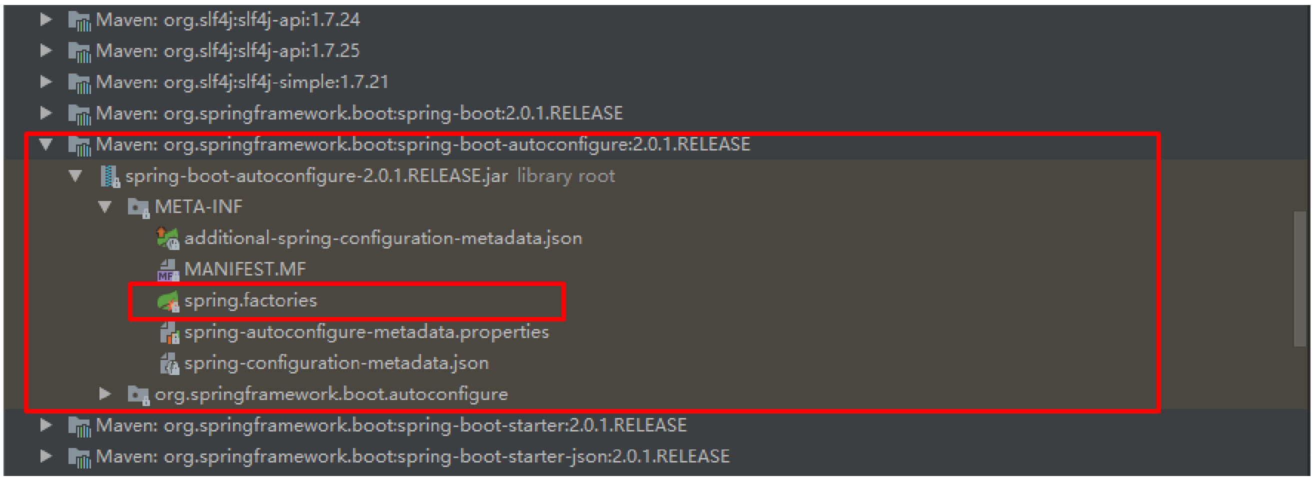
```java
@Target(ElementType.TYPE)
@Retention(RetentionPolicy.RUNTIME)
@Documented
@Inherited
@AutoConfigurationPackage
@Import(AutoConfigurationImportSelector.class)
public @interface EnableAutoConfiguration {
    ... ... ...
}
```

其中，@Import(AutoConfigurationImportSelector.class) 导入了AutoConfigurationImportSelector类

按住Ctrl点击查看AutoConfigurationImportSelector源码

```java
public String[] selectImports(AnnotationMetadata annotationMetadata) {
        ... ... ...
        List<String> configurations = getCandidateConfigurations(annotationMetadata,
                                                                  attributes);
        configurations = removeDuplicates(configurations);
        Set<String> exclusions = getExclusions(annotationMetadata, attributes);
        checkExcludedClasses(configurations, exclusions);
        configurations.removeAll(exclusions);
        configurations = filter(configurations, autoConfigurationMetadata);
        fireAutoConfigurationImportEvents(configurations, exclusions);
        return StringUtils.toStringArray(configurations);
}


protected List<String> getCandidateConfigurations(AnnotationMetadata metadata,
            AnnotationAttributes attributes) {
        List<String> configurations = SpringFactoriesLoader.loadFactoryNames(
                getSpringFactoriesLoaderFactoryClass(), getBeanClassLoader());

        return configurations;
}

```

其中，SpringFactoriesLoader.loadFactoryNames 方法的作用就是从META-INF/spring.factories文件中读取指定类对应的类名称列表



```
Maven: org.slf4j:slf4j-api:1.7.24
Maven: org.slf4j:slf4j-api:1.7.25
Maven: org.slf4j:slf4j-simple:1.7.21
Maven: org.springframework.boot:spring-boot:2.0.1.RELEASE
Maven: org.springframework.boot:spring-boot-autoconfigure:2.0.1.RELEASE
  spring-boot-autoconfigure-2.0.1.RELEASE.jar library root
    META-INF
      additional-spring-configuration-metadata.json
      MANIFEST.MF
      spring.factories
      spring-autoconfigure-metadata.properties
      spring-configuration-metadata.json
    org.springframework.boot.autoconfigure
Maven: org.springframework.boot:spring-boot-starter:2.0.1.RELEASE
Maven: org.springframework.boot:spring-boot-starter-json:2.0.1.RELEASE
```

spring.factories 文件中有关自动配置的配置信息如下：

```
... ... ...

org.springframework.boot.autoconfigure.web.reactive.function.client.WebClientAutoConfiguration,\
org.springframework.boot.autoconfigure.web.servlet.DispatcherServletAutoConfiguration,\
org.springframework.boot.autoconfigure.web.servlet.ServletWebServerFactoryAutoConfiguration,\
org.springframework.boot.autoconfigure.web.servlet.error.ErrorMvcAutoConfiguration,\
org.springframework.boot.autoconfigure.web.servlet.HttpEncodingAutoConfiguration,\
org.springframework.boot.autoconfigure.web.servlet.MultipartAutoConfiguration,\

... ... ...
```

上面配置文件存在大量的以Configuration为结尾的类名称，这些类就是存有自动配置信息的类，而SpringApplication在获取这些类名后再加载

我们以ServletWebServerFactoryAutoConfiguration为例来分析源码：

```java
@Configuration
@AutoConfigureOrder(Ordered.HIGHEST_PRECEDENCE)
@ConditionalOnClass(ServletRequest.class)
@ConditionalOnWebApplication(type = Type.SERVLET)
@EnableConfigurationProperties(ServerProperties.class)
@Import({ ServletWebServerFactoryAutoConfiguration.BeanPostProcessorsRegistrar.class,
        ServletWebServerFactoryConfiguration.EmbeddedTomcat.class,
        ServletWebServerFactoryConfiguration.EmbeddedJetty.class,
        ServletWebServerFactoryConfiguration.EmbeddedUndertow.class })
public class ServletWebServerFactoryAutoConfiguration {
    ... ... ...
}

```

其中，

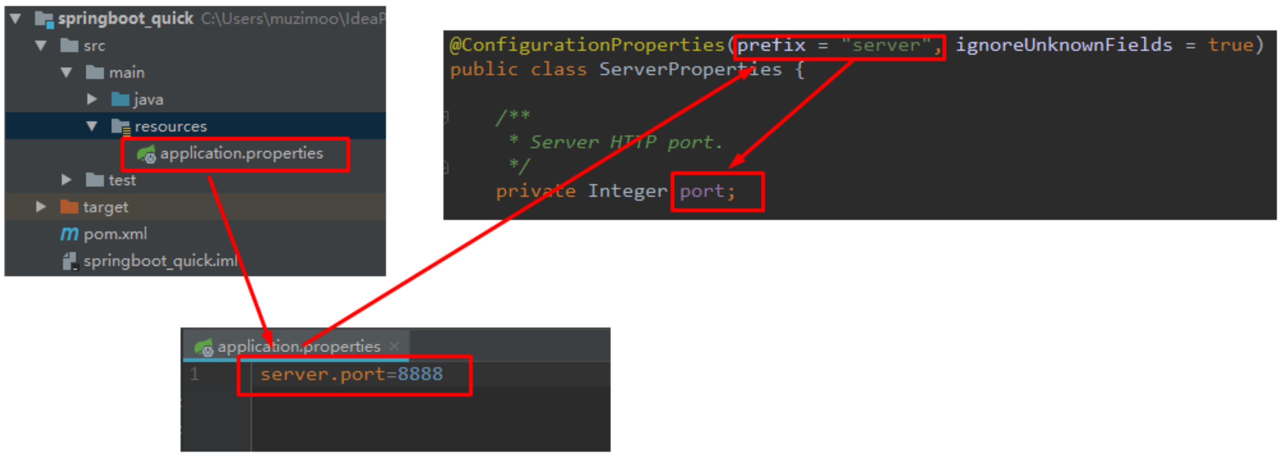
@EnableConfigurationProperties(ServerProperties.class) 代表加载ServerProperties服务器配置属性类

进入ServerProperties.class源码如下：

```java
@ConfigurationProperties(prefix = "server", ignoreUnknownFields = true)
public class ServerProperties {

    /**
     * Server HTTP port.
     */
    private Integer port;

    /**
     * Network address to which the server should bind.
     */
    private InetAddress address;

    ... ... ...

}
```

其中，

prefix = "server" 表示SpringBoot配置文件中的前缀，SpringBoot会将配置文件中以server开始的属性映射到该类的字段中。映射关系如下：



```java
@ConfigurationProperties(prefix = "server", ignoreUnknownFields = true)
public class ServerProperties {

    /**
     * Server HTTP port.
     */
    private Integer port;
```

```properties
server.port=8888
```

四、SpringBoot的配置文件

4.1 SpringBoot配置文件类型

4.1.1 SpringBoot配置文件类型和作用

SpringBoot是基于约定的，所以很多配置都有默认值，但如果想使用自己的配置替换默认配置的话，就可以使用application.properties或者application.yml（application.yaml）进行配置。

SpringBoot默认会从Resources目录下加载application.properties或application.yml（application.yaml）文件

其中，application.properties文件是键值对类型的文件，之前一直在使用，所以此处不在对properties文件的格式进行阐述。除了properties文件外，SpringBoot还可以使用yml文件进行配置，下面对yml文件进行讲解。

4.1.2 application.yml配置文件

4.1.2.1 yml配置文件简介

YML文件格式是YAML (YAML Aint Markup Language)编写的文件格式，YAML是一种直观的能够被电脑识别的的数据数据序列化格式，并且容易被人类阅读，容易和脚本语言交互的，可以被支持YAML库的不同的编程语言程序导入，比如： C/C++, Ruby, Python, Java, Perl, C#, PHP等。YML文件是以数据为核心的，比传统的xml方式更加简洁。

YML文件的扩展名可以使用.yml或者.yaml。

4.1.2.2 yml配置文件的语法

4.1.2.2.1 配置普通数据

- 语法： key: value
- 示例代码：

-
  ```yaml
  name: haohao
  ```
- 注意：value之前有一个空格

4.1.2.2.2 配置对象数据

- 语法：

  key:

  key1: value1

  key2: value2

  或者：

  key: {key1: value1,key2: value2}
- 示例代码：

-
  ```yaml
  person:
    name: haohao
    age: 31
    addr: beijing

  #或者

  person: {name: haohao,age: 31,addr: beijing}
  ```
- 注意：key1前面的空格个数不限定，在yml语法中，相同缩进代表同一个级别

4.1.2.2.2 配置Map数据

同上面的对象写法

4.1.2.2.3 配置数组（List、Set）数据

- 语法：

  key:

  - value1

  - value2

  或者：

  key: [value1,value2]

- 示例代码：

-
```yaml
city:
  - beijing
  - tianjin
  - shanghai
  - chongqing

#或者

city: [beijing,tianjin,shanghai,chongqing]

#集合中的元素是对象形式
student:
  - name: zhangsan
    age: 18
    score: 100
  - name: lisi
    age: 28
    score: 88
  - name: wangwu
    age: 38
    score: 90
```

- 注意：value1与之间的 - 之间存在一个空格

4.1.3 SpringBoot配置信息的查询

上面提及过，SpringBoot的配置文件，主要的目的就是对配置信息进行修改的，但在配置时的key从哪里去查询呢？我们可以查阅SpringBoot的官方文档

文档URL：https://docs.spring.io/spring-boot/docs/2.0.1.RELEASE/reference/htmlsingle/#common-application-properties

常用的配置摘抄如下：

```properties
# QUARTZ SCHEDULER (QuartzProperties)
spring.quartz.jdbc.initialize-schema=embedded # Database schema initialization mode.
spring.quartz.jdbc.schema=classpath:org/quartz/impl/jdbcjobstore/tables_@@platform@@.sql # Path to the SQL file to use to initialize the database schema.

spring.quartz.job-store-type=memory # Quartz job store type.
spring.quartz.properties.*= # Additional Quartz Scheduler properties.

# ----------------------------------------
# WEB PROPERTIES
# ----------------------------------------

# EMBEDDED SERVER CONFIGURATION (ServerProperties)
server.port=8080 # Server HTTP port.
server.servlet.context-path= # Context path of the application.
server.servlet.path=/ # Path of the main dispatcher servlet.

# HTTP encoding (HttpEncodingProperties)
spring.http.encoding.charset=UTF-8 # Charset of HTTP requests and responses. Added to the "Content-Type" header if not set explicitly.

# JACKSON (JacksonProperties)
spring.jackson.date-format= # Date format string or a fully-qualified date format class name. For instance, `yyyy-MM-dd HH:mm:ss`.

# SPRING MVC (WebMvcProperties)
spring.mvc.servlet.load-on-startup=-1 # Load on startup priority of the dispatcher servlet.
spring.mvc.static-path-pattern=/** # Path pattern used for static resources.
spring.mvc.view.prefix= # Spring MVC view prefix.
spring.mvc.view.suffix= # Spring MVC view suffix.

# DATASOURCE (DataSourceAutoConfiguration & DataSourceProperties)
spring.datasource.driver-class-name= # Fully qualified name of the JDBC driver. Auto-detected based on the URL by default.
spring.datasource.password= # Login password of the database.
spring.datasource.url= # JDBC URL of the database.
spring.datasource.username= # Login username of the database.

# JEST (Elasticsearch HTTP client) (JestProperties)
spring.elasticsearch.jest.password= # Login password.
spring.elasticsearch.jest.proxy.host= # Proxy host the HTTP client should use.
spring.elasticsearch.jest.proxy.port= # Proxy port the HTTP client should use.
spring.elasticsearch.jest.read-timeout=3s # Read timeout.
spring.elasticsearch.jest.username= # Login username.

```

我们可以通过配置application.poperties 或者 application.yml 来修改SpringBoot的默认配置

例如：

application.properties文件

```
server.port=8888
server.servlet.context-path=demo
```

application.yml文件

```yaml
server:
  port: 8888
  servlet:
    context-path: /demo
```

4.2 配置文件与配置类的属性映射方式

4.2.1 使用注解@Value映射

我们可以通过@Value注解将配置文件中的值映射到一个Spring管理的Bean的字段上

例如：

application.properties配置如下：

```
person:
  name: zhangsan
  age: 18
```

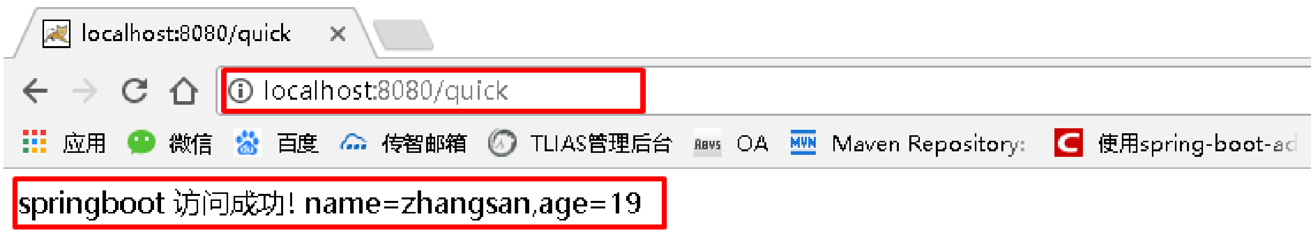
或者，application.yml配置如下：

```yaml
person:
  name: zhangsan
  age: 18
```

实体Bean代码如下：

```java
@Controller
public class QuickStartController {

    @Value("${person.name}")
    private String name;
    @Value("${person.age}")
    private Integer age;


    @RequestMapping("/quick")
    @ResponseBody
    public String quick(){
        return "springboot 访问成功! name="+name+",age="+age;
    }

}
```

浏览器访问地址：http://localhost:8080/quick 结果如下：



```
springboot 访问成功! name=zhangsan,age=19
```

4.2.2 使用注解@ConfigurationProperties映射

通过注解@ConfigurationProperties(prefix="配置文件中的key的前缀")可以将配置文件中的配置自动与实体进行映射

application.properties配置如下:

```
person:
  name: zhangsan
  age: 18
```

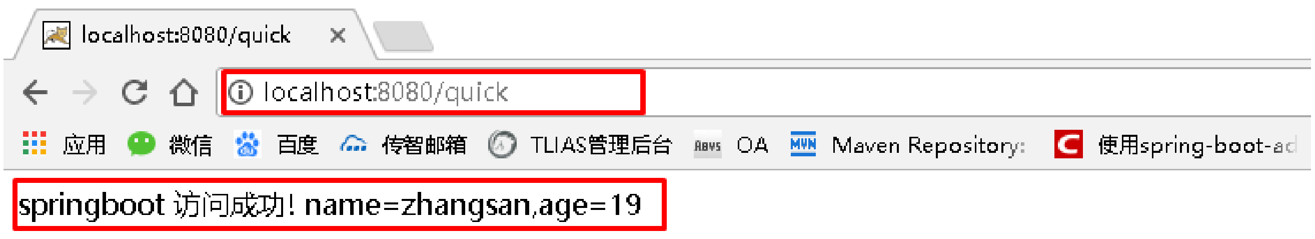
或者，application.yml配置如下:

```
person:
  name: zhangsan
  age: 18
```

实体Bean代码如下:

```java
@Controller
@ConfigurationProperties(prefix = "person")
public class QuickStartController {

    private String name;
    private Integer age;

    @RequestMapping("/quick")
    @ResponseBody
    public String quick(){
        return "springboot 访问成功! name="+name+",age="+age;
    }

    public void setName(String name) {
        this.name = name;
    }

    public void setAge(Integer age) {
        this.age = age;
    }
}
```

浏览器访问地址：http://localhost:8080/quick 结果如下：



springboot 访问成功! name=zhangsan,age=19

注意：使用@ConfigurationProperties方式可以进行配置文件与实体字段的自动映射，但需要字段必须提供set方法才可以，而使用@Value注解修饰的字段不需要提供set方法

五、SpringBoot与整合其他技术

5.1 SpringBoot整合Mybatis

5.1.1 添加Mybatis的起步依赖

```
<!--mybatis起步依赖-->
<dependency>
    <groupId>org.mybatis.spring.boot</groupId>
    <artifactId>mybatis-spring-boot-starter</artifactId>
    <version>1.1.1</version>
</dependency>
```

5.1.2 添加数据库驱动坐标

```
<!-- MySQL连接驱动 -->
<dependency>
    <groupId>mysql</groupId>
    <artifactId>mysql-connector-java</artifactId>
</dependency>
```

5.1.3 添加数据库连接信息

在application.properties中添加数据量的连接信息

```
#DB Configuration:
spring.datasource.driverClassName=com.mysql.jdbc.Driver
spring.datasource.url=jdbc:mysql://127.0.0.1:3306/test?useUnicode=true&characterEncoding=utf8
spring.datasource.username=root
spring.datasource.password=root
```

5.1.4 创建user表

在test数据库中创建user表

```sql
-- ----------------------------
-- Table structure for `user`
-- ----------------------------
DROP TABLE IF EXISTS `user`;
CREATE TABLE `user` (
  `id` int(11) NOT NULL AUTO_INCREMENT,
  `username` varchar(50) DEFAULT NULL,
  `password` varchar(50) DEFAULT NULL,
  `name` varchar(50) DEFAULT NULL,
  PRIMARY KEY (`id`)
) ENGINE=InnoDB AUTO_INCREMENT=10 DEFAULT CHARSET=utf8;

-- ----------------------------
-- Records of user
-- ----------------------------
INSERT INTO `user` VALUES ('1', 'zhangsan', '123', '张三');
INSERT INTO `user` VALUES ('2', 'lisi', '123', '李四');
```

5.1.5 创建实体Bean

```java
public class User {
    // 主键
    private Long id;
    // 用户名
    private String username;
    // 密码
    private String password;
    // 姓名
    private String name;

    //此处省略getter和setter方法 .. ..

}
```

5.1.6 编写Mapper

```java
@Mapper
public interface UserMapper {
    public List<User> queryUserList();
}
```

注意：@Mapper标记该类是一个mybatis的mapper接口，可以被spring boot自动扫描到spring上下文中

5.1.7 配置Mapper映射文件

在src\main\resources\mapper路径下加入UserMapper.xml配置文件"

```xml
<?xml version="1.0" encoding="utf-8" ?>
<!DOCTYPE mapper PUBLIC "-//mybatis.org//DTD Mapper 3.0//EN"
"http://mybatis.org/dtd/mybatis-3-mapper.dtd" >
<mapper namespace="com.itheima.mapper.UserMapper">
    <select id="queryUserList" resultType="user">
        select * from user
    </select>
</mapper>
```

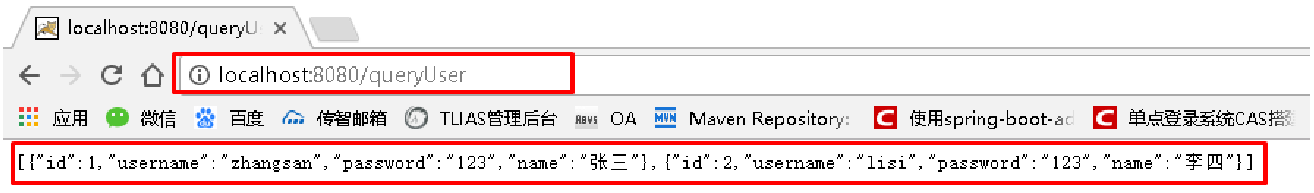
5.1.8 在application.properties中添加mybatis的信息

```properties
#spring集成Mybatis环境
#pojo别名扫描包
mybatis.type-aliases-package=com.itheima.domain
#加载Mybatis映射文件
mybatis.mapper-locations=classpath:mapper/*Mapper.xml
```

5.1.9 编写测试Controller

```java
@Controller
public class MapperController {

    @Autowired
    private UserMapper userMapper;

    @RequestMapping("/queryUser")
    @ResponseBody
    public List<User> queryUser(){
        List<User> users = userMapper.queryUserList();
        return users;
    }

}
```

5.1.10 测试



```
[{"id":1,"username":"zhangsan","password":"123","name":"张三"},{"id":2,"username":"lisi","password":"123","name":"李四"}]
```

5.2 SpringBoot整合Junit

5.2.1 添加Junit的起步依赖

```xml
<!--测试的起步依赖-->
<dependency>
    <groupId>org.springframework.boot</groupId>
    <artifactId>spring-boot-starter-test</artifactId>
    <scope>test</scope>
</dependency>
```

5.2.2 编写测试类

```java
package com.itheima.test;

import com.itheima.MySpringBootApplication;
import com.itheima.domain.User;
import com.itheima.mapper.UserMapper;
import org.junit.Test;
import org.junit.runner.RunWith;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.boot.test.context.SpringBootTest;
import org.springframework.test.context.junit4.SpringRunner;

import java.util.List;

@RunWith(SpringRunner.class)
@SpringBootTest(classes = MySpringBootApplication.class)
public class MapperTest {

    @Autowired
    private UserMapper userMapper;

    @Test
    public void test() {
        List<User> users = userMapper.queryUserList();
        System.out.println(users);
    }

}
```

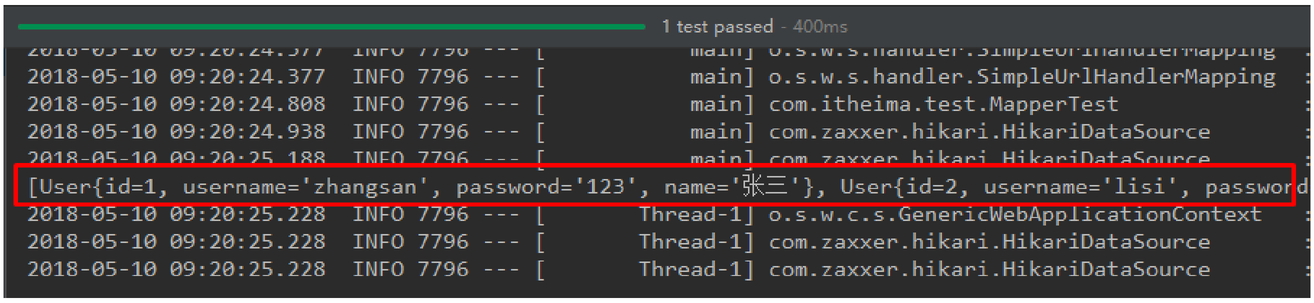
其中，

SpringRunner继承自SpringJUnit4ClassRunner，使用哪一个Spring提供的测试测试引擎都可以

```java
public final class SpringRunner extends SpringJUnit4ClassRunner
```

@SpringBootTest的属性指定的是引导类的字节码对象

5.2.3 控制台打印信息



```
2018-05-10 09:20:24.377  INFO 7796 --- [           main] o.s.w.s.handler.SimpleUrlHandlerMapping  :
2018-05-10 09:20:24.377  INFO 7796 --- [           main] o.s.w.s.handler.SimpleUrlHandlerMapping  :
2018-05-10 09:20:24.808  INFO 7796 --- [           main] com.itheima.test.MapperTest              :
2018-05-10 09:20:24.938  INFO 7796 --- [           main] com.zaxxer.hikari.HikariDataSource       :
2018-05-10 09:20:25.188  INFO 7796 --- [           main] com.zaxxer.hikari.HikariDataSource       :
[User{id=1, username='zhangsan', password='123', name='张三'}, User{id=2, username='lisi', password
2018-05-10 09:20:25.228  INFO 7796 --- [       Thread-1] o.s.w.c.s.GenericWebApplicationContext   :
2018-05-10 09:20:25.228  INFO 7796 --- [       Thread-1] com.zaxxer.hikari.HikariDataSource       :
2018-05-10 09:20:25.228  INFO 7796 --- [       Thread-1] com.zaxxer.hikari.HikariDataSource       :
```

5.3 SpringBoot整合Spring Data JPA

5.3.1 添加Spring Data JPA的起步依赖

```xml
<!-- springBoot JPA的起步依赖 -->
<dependency>
    <groupId>org.springframework.boot</groupId>
    <artifactId>spring-boot-starter-data-jpa</artifactId>
</dependency>
```

5.3.2 添加数据库驱动依赖

```xml
<!-- MySQL连接驱动 -->
<dependency>
    <groupId>mysql</groupId>
    <artifactId>mysql-connector-java</artifactId>
</dependency>
```

5.3.3 在application.properties中配置数据库和jpa的相关属性

```properties
#DB Configuration:
spring.datasource.driverClassName=com.mysql.jdbc.Driver
spring.datasource.url=jdbc:mysql://127.0.0.1:3306/test?useUnicode=true&characterEncoding=utf8
spring.datasource.username=root
spring.datasource.password=root

#JPA Configuration:
spring.jpa.database=MySQL
spring.jpa.show-sql=true
spring.jpa.generate-ddl=true
spring.jpa.hibernate.ddl-auto=update
spring.jpa.hibernate.naming_strategy=org.hibernate.cfg.ImprovedNamingStrategy
```

5.3.4 创建实体配置实体

```java
@Entity
```

```java
public class User {
    // 主键
    @Id
    @GeneratedValue(strategy = GenerationType.IDENTITY)
    private Long id;
    // 用户名
    private String username;
    // 密码
    private String password;
    // 姓名
    private String name;

    //此处省略setter和getter方法... ...
}
```

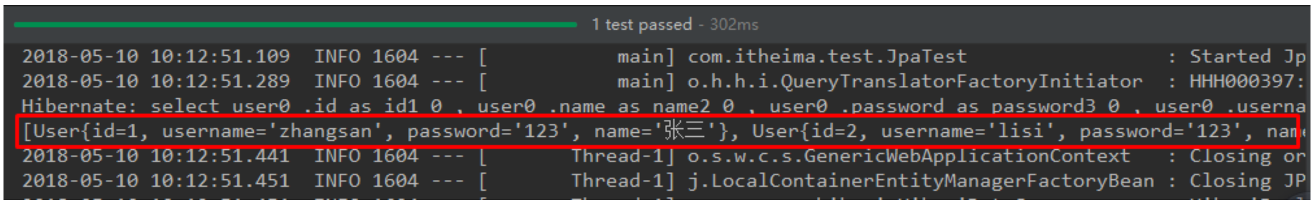
5.3.5 编写UserRepository

```java
public interface UserRepository extends JpaRepository<User,Long>{
    public List<User> findAll();
}
```

5.3.6 编写测试类

```java
@RunWith(SpringRunner.class)
@SpringBootTest(classes=MySpringBootApplication.class)
public class JpaTest {

    @Autowired
    private UserRepository userRepository;

    @Test
    public void test(){
        List<User> users = userRepository.findAll();
        System.out.println(users);
    }

}
```

5.3.7 控制台打印信息



```
1 test passed - 302ms
2018-05-10 10:12:51.109  INFO 1604 --- [           main] com.itheima.test.JpaTest                 : Started Jp
2018-05-10 10:12:51.289  INFO 1604 --- [           main] o.h.h.i.QueryTranslatorFactoryInitiator  : HHH000397:
Hibernate: select user0_.id as id1_0_, user0_.name as name2_0_, user0_.password as password3_0_, user0_.userna
[User{id=1, username='zhangsan', password='123', name='张三'}, User{id=2, username='lisi', password='123', nam
2018-05-10 10:12:51.441  INFO 1604 --- [       Thread-1] o.s.w.c.s.GenericWebApplicationContext   : Closing or
2018-05-10 10:12:51.451  INFO 1604 --- [       Thread-1] j.LocalContainerEntityManagerFactoryBean : Closing JP
```

注意：如果是jdk9，执行报错如下：

```
Caused by: java.lang.ClassNotFoundException: javax.xml.bind.JAXBException
    at java.base/jdk.internal.loader.BuiltinClassLoader.loadClass(BuiltinClassLoader.java:582)
    at java.base/jdk.internal.loader.ClassLoaders$AppClassLoader.loadClass(ClassLoaders.java:185)
    at java.base/java.lang.ClassLoader.loadClass(ClassLoader.java:496)
    ... 50 more
```

原因：jdk缺少相应的jar

解决方案：手动导入对应的maven坐标，如下：

```
<!--jdk9需要导入如下坐标-->
<dependency>
    <groupId>javax.xml.bind</groupId>
    <artifactId>jaxb-api</artifactId>
    <version>2.3.0</version>
</dependency>
```

5.4 SpringBoot整合Redis

5.4.1 添加redis的起步依赖

```
<!-- 配置使用redis启动器 -->
<dependency>
    <groupId>org.springframework.boot</groupId>
    <artifactId>spring-boot-starter-data-redis</artifactId>
</dependency>
```

5.4.2 配置redis的连接信息

```
#Redis
spring.redis.host=127.0.0.1
spring.redis.port=6379
```

5.4.3 注入RedisTemplate测试redis操作

```
@RunWith(SpringRunner.class)
@SpringBootTest(classes = SpringbootJpaApplication.class)
public class RedisTest {

    @Autowired
    private UserRepository userRepository;

    @Autowired
    private RedisTemplate<String, String> redisTemplate;

    @Test
    public void test() throws JsonProcessingException {
        //从redis缓存中获得指定的数据
```

```java
        String userListData = redisTemplate.boundValueOps("user.findAll").get();
        //如果redis中没有数据的话
        if(null==userListData){
            //查询数据库获得数据
            List<User> all = userRepository.findAll();
            //转换成json格式字符串
            ObjectMapper om = new ObjectMapper();
            userListData = om.writeValueAsString(all);
            //将数据存储到redis中，下次在查询直接从redis中获得数据，不用在查询数据库
            redisTemplate.boundValueOps("user.findAll").set(userListData);
            System.out.println("===============从数据库获得数据===============");
        }else{
            System.out.println("===============从redis缓存中获得数据===============");
        }

        System.out.println(userListData);

    }

}
```