

Spring and Spring Boot

An Exercise-Driven Approach

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Spring

Project infrastructure

Spring

Lifecycle management of "beans"

Any POJO with getters/setters

Spring

Provides "services"

transactions, security, persistence, ...

Spring

Library of beans available

transaction managers

rest clients

DB connection pools

testing mechanisms

Spring

Code to interfaces

Library has many interfaces, each with many implementations

Spring

Need "metadata"

Tells Spring what to instantiate and configure

XML → old style

Annotations → better

JavaConfig → preferred

All still supported

Spring

Application Context

Collection of managed beans

the "lightweight" Spring container

Spring Boot

Easy **creation and configuration** for Spring apps

Many "starters"

Gradle or Maven based

Automatic configuration based on classpath

If you add JDBC driver, it adds DataSource bean

Dependency Injection

- Spring adds dependencies on request
 - Annotate field, or setter, or constructor
 - `@Autowired` → autowiring by type
 - `@Resource` (from Java EE) → autowiring by (bean) name, then by type if necessary

Spring Initializr

Web site for creating new Spring (Boot) apps

<http://start.spring.io>

Incorporated into major IDEs

Select features you want

Download zip containing build file

Spring Boot

Application with `main method` created automatically

Annotated with `@SpringBootApplication`

Gradle or Maven build produces executable jar in build/libs folder

```
$ java -jar appname.jar
```

Or use gradle task `bootRun`

Spring MVC

Annotation based MVC framework

`@Controller` → controllers

`@GetMapping` → annotations for HTTP methods

`@RequestParam` and more for model parameters

Rest Client

Spring includes a class called `RestTemplate`

- Access RESTful web services
- Set HTTP methods, headers, query string, templates
- Use `RestTemplateBuilder` to create one
- Use content negotiation to return JSON or XML
- Convenient `getForObject(url, class)` method

Newer reactive client: `WebClient`

Logging

Spring libraries include **SLF4J** automatically

Use `LoggerFactory.getLogger(... class name ...)`

Returns an `org.slf4j.Logger` instance

Invoke logging methods as usual

Testing

Spring tests automatically include special JUnit 5 extension

```
@ExtendWith(SpringExtension.class)
```

Annotate test class with `@SpringBootTest`

Annotate tests with `@Test`

Use normal asserts as usual

Testing

Special annotations for web integration tests

```
@WebMvcTest(... controller class ...)
```

MockMvc package

MockMvcRequestBuilders

MockMvcRequestMatchers

Parsing JSON

Several options, but one is the Jackson JSON 2 library

Create classes that map to JSON response

```
restTemplate.getForObject(url, ... your class ...)
```

Maps JSON to Java objects

Component Scan

Spring detects annotated classes in the expected folders

`@Component` → Spring bean

`@Controller`, `@Service`, `@Repository` → based on `@Component`

Application properties

Two options for file name

Default folder is `src/main/resources`

`application.properties` → standard Java properties file

`application.yml` → YAML format

Persistence

Spring provides `JdbcTemplate`

Easy to access and use relational databases

Best if you already have the SQL you want to use

Persistence

More conventions:

Two standard files in `src/main/resources`

`schema.sql` → create test database

`data.sql` → populate test database

Both executed on startup, using DB connection pool

JdbcTemplate

Standard practice:

Create DAO class

Autowire DataSource into constructor

Instantiate JdbcTemplate from DataSource

Spring boot lets you autowire the JdbcTemplate directly

JdbcTemplate

Use `queryForObject` to map DB row to Java class

(query method does the same for all rows)

In Java 7, uses inner class that implements `RowMapper<MyClass>`

In Java 8, can use lambda expression

Spring 5, Spring Boot 2 both require Java 8+

H2 Database

- Add the H2 dependency
 - `runtime('com.h2database:h2')`
 - Automatically adds DataSource for it

If you add the web starter and the dev-tools dependency,

you also get the H2 console

<http://localhost:8080/h2-console>

DB URL (by default) is `jdbc:h2:mem:testdb`

SimpleJdbcInsert

Specify table name and generated key columns

Create a `SqlParameterSource`

Run `executeAndReturnKey(parameters)`

Transactions

Spring transactions configured with `@Transactional`

Spring uses `TransactionManager` to talk to resource

usually a relational DB, but other options available

@Transactional

Each method wrapped in a REQUIRED tx by default

Propagation levels:

REQUIRED, REQUIRES_NEW, SUPPORTS,
NOT_SUPPORTED

In tests, transactions in test methods roll back by default

Can configure isolation levels:

READ_UNCOMMITTED, READ_COMMITTED,
REPEATABLE_READ, SERIALIZABLE

JPA

Java Persistence API

Uses a "provider" → **Hibernate** most common

Annotate entity classes

`@Entity`, `@Table`, `@Column`, `@Id`, `@GeneratedValue`

use in Spring `@Repository` → exception translation

`@PersistenceContext` → `EntityManager`

Spring Data

Large, powerful API

Create interface that extends a given one

`CrudRepository`, `PagingAndSortingRepository`

We'll use `JpaRepository<class, serializable>`

Add your own finder method declarations

All SQL generated automatically

How Does Spring Do Its Job?

- Load bean definitions from all sources
- Post-process bean definitions
 - Substitute values at config time, like JDBC properties
 - Read values from `application.yml` or `application.properties`
- Create and configure all the beans
 - Set properties and dependencies
- Run bean post-processors
 - Generate any necessary proxies

HAL Browser

Browser used to access RESTful web services

Executes HTTP methods

Parses JSON responses

Handles hypermedia

Docs

You are on [Safari](#), so...

- [Learning Path: Learn Spring and Spring Boot](#)
 - Includes Spring Framework Essentials
- [Spring in Action, 4th Edition](#)
- [Spring Boot in Action](#)
- ... lots more ...