Spring and Spring Boot

An Exercise-Driven Approach

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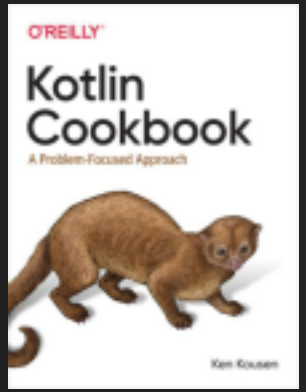

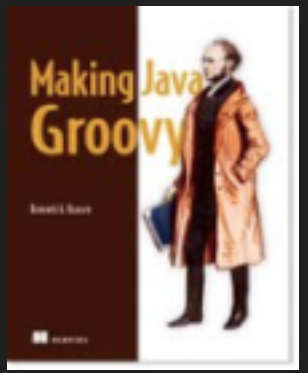

Spring

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 …