Spring MVC

Web Applications and Restful Services

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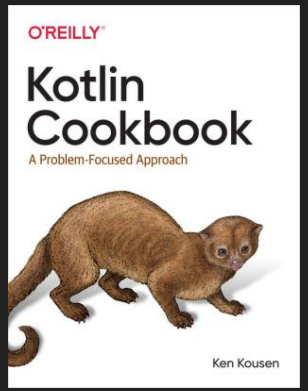
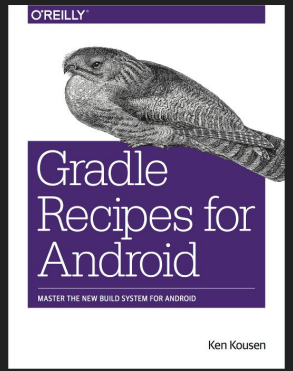
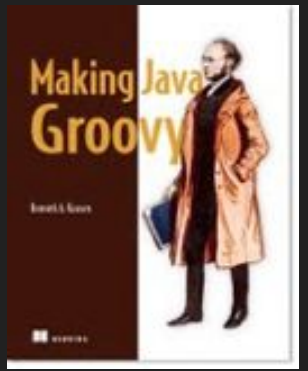






GitHub repositories

https://github.com/kousen/shopping_rest → Web and Rest API for products

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

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

Spring Initializr

Website for creating new Spring (Boot) apps

http://start.spring.io

Incorporated into major IDEs

Select features you want

Download zip containing build file

Spring MVC Starters

Add either web and/or webflux starter

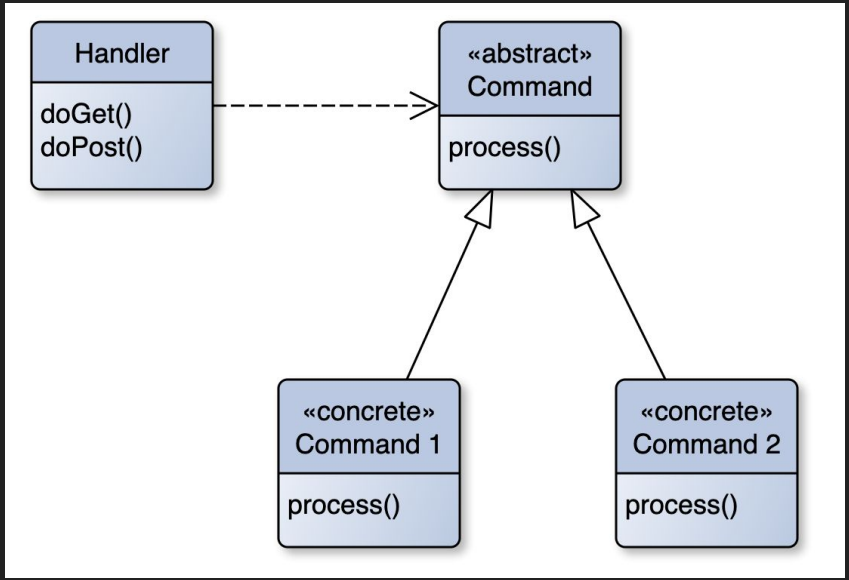
spring-boot-starter-web → Spring MVC

spring-boot-starter-webflux → Reactive Spring

Need this for WebClient

Spring MVC

Designed around Front Controller design pattern



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`

@SpringBootApplication

Composite annotation, includes:

- `@SpringConfiguration` (`@Configuration` by another name)
- `@EnableAutoConfiguration`
- `@ComponentScan`

DispatcherServlet

- Central servlet that acts as front controller
  - Spring Boot sets up and maps automatically

Special Beans

Spring library useful bean types

- `HandlerMapping` and `HandlerAdapter` → maps URLs to bean methods
- `ViewResolver` → Converts strings to views
- `HandlerExceptionResolver` → Map exceptions/errors to views

Processing Requests

DispatcherServlet:

- Find WebApplicationContext and bind request
- Use locale resolver, if necessary
- Use theme resolver, if necessary
- Use multipart file resolver, if necessary
- Use HandlerMapping to invoke method
- Use ViewResolver to connect to view

Request Processing

Everything can be configured and customized

Spring Boot Simplifications

Spring Boot autoconfiguration provides:

- ContentNegotiatingViewResolver
- BeanNameViewResolver
- HttpMessageConverters
- Static content:
  - /static or /public or /resources directory

Path Matching and Content Negotiation

Disables suffix pattern matching by default

Uses Accept headers for content negotiation

Template Engines for dynamic HTML content

- FreeMarker
- Groovy
- Thymeleaf
- Mustache

All use /src/main/resources/templates by default

Spring MVC

Annotation based MVC framework

`@Controller, @RestController` → controllers

`@GetMapping` → annotations for HTTP methods
Similar for POST, PUT, PATCH, DELETE, ...

`@RequestParam` and more for model parameters

`@PathVariable` for URI templates

Custom Error Page

In folder `src/main/resources/public/error`

Add `404.html` (or other error code)

More general, add 5xx.html, etc

CORS

Cross-origin resource sharing

Easy way: `@CrossOrigin` annotation

More complex: Register a `WebMvcConfigurer` bean
with `addCorsMappings(CorsRegistry)` method

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`

Testing

Integration tests:

- `WebTestClient` (newer, reactive)
- `TestRestTemplate` (older, synchronous)

Mock Objects

Includes Mockito

`@MockBean`

Set expectations and verify as usual

Component Scan

Spring detects annotated classes in the expected folders

`@Component` → Spring bean

`@Controller`, `@Service`, `@Repository`, `@Configuration`
→ 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

Web Apps

- Add `Model` parameter to controller methods
  - Carries data from controllers to views
  - Model attributes copied into each request

Validation

- Spring uses any JSR-303 implementation on classpath
  - Hibernate validator by default
  - `@Valid`
  - `@Min`, `@Max`, `@NotBlank`, ...

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

application.properties:
spring.datasource.schema, spring.datasource.data

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

Profiles

Create the same beans to be used under different situations

Either:

Multiple files with profile name in them

application-{profilename}.properties

Or:

One YAML file with section separated by ---

Profiles

```
logging:
        level:
                org.springframework.web: DEBUG
---
spring:
        profiles: prod
        datasource: …
---
spring:
        profiles: dev
        datasource: ...
```

Profiles

Annotate beans for specific profiles

```
@Profile("dev")
@Profile({"dev","prod"})
@Profile("!test")
```

Set the active profile:

spring.profiles.active = prod

Set SPRING_PROFILES_ACTIVE environment variable

--spring.profiles.active=prod on command line

Web.fn

- Functional approach
  - Router function bean
    - maps URLs to handler methods
    - Kotlin has a nice DSL for it
  - Hander class
    - all methods take ServerRequest and return ServerResponse

References

- Spring in Action, 5th edition, by Craig Walls
- For Hibernate/JPA
  - Pro JPA 2, 2nd edition (on Safari)
  - https://thoughts-on-java.org/ has lots of Hibernate tips
  - https://vladmihalcea.com/books/high-performance-java-persistence/
- Online reference docs for:
  - Spring Framework
  - Spring Boot
  - Spring Data
  - Spring Security