Reactive Streams using Spring Webflux 6 Bogdan Sucaciu

A close-up of a webflux

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Reactive vs Imperative Programming

A screenshot of a computer

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Imperative

-Code executions gets blocked until we get the data we requested

Reactive

-Code execution will continue even when dealing with blocking operation

-Data comes in as streams (piece by piece) instead of blocks (one big chunk)

-Functional:

-asynchronous code can be implemented either with callbacks or futures but Functional change imperative blocks of codes into functions and chain them to the desired result

A purple and white rectangular object with text

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Harddrive, I/O includes DB and network calls

Reactive Streams

Reactive Programming

-Set of principles with no standards or implementation

Reactive Streams

-Standards are defined by this

A diagram of a company

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Components

Publisher

-code providing the data under the form of data stream

Subscriber

-Consumes data and process it

A diagram of different types of software

Description automatically generatedSubscription

-Connect to publisher and receive data under the form of data stream

Processor

-Combination?

Project Reactor

-Library that implements all reactive streams specifications

A blue and orange rectangles with white text

Description automatically generated

Flux: represents a flux of data

Mono: one data is sent

A black text with orange and black text

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-In case something bad happens, we can handle it gracefully

A diagram of a web application

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-MVC framework is based on Servlet API (old specification that provides web capabilities in blocking fashion)

-Spring wanted non blocking capabilities so it made WebFlux (stack?).

-WebFlux is using Project Reactor under the hood and using Reactive Streams specification and not the Servlet API

A diagram of a flowchart

Description automatically generated

-The need came from Microservices

Project Loom

A diagram of gears and a diagram of a diagram

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MongoDb using Docker



-d, we use the official mongo image

A screenshot of a computer code

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-just method accepts any object as input

A screenshot of a computer

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-Think of range as for loop

Spring MVC is Apache Tomcat but started Netty?

Reactive Programming

-non-blocking asynchronous components

-data streams

-functional programming

Exploring Project Reactor

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A close up of a black background

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-Use Spring Data JPA Library with Spring Data R2DBC (Reactive Relational DB Connectivity) for relational DB

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-Switch to these driver

Map

DTO

-Basically we don’t want to expose our internal data structure



-MethodReference instead of lambda expression

A screen shot of a computer program

Description automatically generatedDTO

StockRequest.java

A screen shot of a computer code

Description automatically generated

StockResponse.java

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Description automatically generated

Error Handling

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-Can no longer use try catch to transform and recover from exceptions

A diagram of error

Description automatically generated

oOnErrorReturn: provides a fallback object

onErrorResume: similar but takes exception as lambda argument

onErrorMap: transform one exception to another

A close up of words

Description automatically generated

-Wont work because the exception is thrown during the reactive pipeline

A screenshot of a computer code

Description automatically generated

-just sends through a reactive pipeline

-flatmap: Unwrapping Mono/Flux from its arguments

Example:

-stocksRepository.save(stock) returns a Mono, if we just a map it would return Mono<Mono<>>

Peek

A diagram of a program

Description automatically generated

doFirst: called before subscription

doOnSubscribe: immediately after subscriber initiates a subscription

doOnRequest: when sending a request

doOnNext: inspects data items published on stream

doOnTerminate: executes every time stream ends (completion or error) executes before

doAfterTerminate: executes after last element is propagated to stream

Using WebClient

-Probably use REST template for API calls, won’t work for reactive paradigm

-WebClient replaces Spring REST template

A diagram of a service

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-A popular structure

A screenshot of a computer program

Description automatically generatedClient

-makes API calls to other apps

A close-up of a purple square

Description automatically generated

-retrieve triggers the request

A diagram of a computer

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-Use the flatmap if inner lambda expressions returns a mono

-singleOrEmpty(): transfer a Flux into a Mono because we only expect one

A computer screen shot of a program code

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@Transactional

-The save to the DB will be rolled back if an error occurs

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-Order matters

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-Difference between bodyToMono and createException is that we can pass more information using a DTO

-Chosing one may come down to the upstream app is sending an usable response body

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-exchange gives us access to the entire response

- a lot more flexibility

WebClient Filters

-

Testing Reactive Streams

-Reactive apps require specialized libraries because regular libraries are not capable of considering time factor

A screen shot of a pyramid

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Unit

-Smaller in size, larger in numbers and primarily designed to test business logic

Integration

-designed to test integration between two modules/components (like app and database)

E2E

-designed to test user flows

A diagram of a service

Description automatically generated

-Since we are testing at class level, we don’t have anything Spring specific

Project Reactor test library

StepVerifier

-Can test reactive stream defined by a mono/flux and check how it behaves when we subscribe to it

Test Publisher

-more advanced test cases by allowing us to manage the source of the data

-we can choose which signals are emitted and when

PublisherProbe

-we can inspect and assert intermediate subsequence

A diagram of a website

Description automatically generated

-expect we are comparing onNext item with a predefined object

A screen shot of a computer

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@InjectMocks

-Use Mockito to generate the mocks based on class dependencies

@BeforeEach

-inside setup(), will initialize all mocks declared inside class (@Mocks)

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3 parts of Unit Test

GIVEN

-define the prerequisites for the test

WHEN

-Execute the method being tested

-Use StepVerifier.create()

THEN

-

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-Common mistake is we need an onNext otherwise will error out because it expected onComplete

Negative Unit Tests

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Integration Tests