Comparing & Contrasting
Spring WebMVC & WebFlux

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Learning Objectives in this Lesson

- Recognize the similarities & differences between Spring WebMVC & WebFlux frameworks supported by Spring Boot 2.0

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**Reactive Stack**
Spring WebFlux is a non-blocking web framework built from the ground up to take advantage of multi-core, next-generation processors and handle massive numbers of concurrent connections.

**Servlet Stack**
Spring MVC is built on the Servlet API and uses a synchronous blocking I/O architecture with a one-request-per-thread model.

- Netty, Servlet 3.1+ Containers
- Reactive Streams Adapters
- Spring Security Reactive

- Spring WebFlux

- Spring Data Reactive Repositories
  - Mongo, Cassandra, Redis, Couchbase

- Servlet Containers
- Servlet API
- Spring Security
- Spring MVC

- Spring Data Repositories
  - JDBC, JPA, NoSQL
Comparing & Contrasting
Spring WebMVC & WebFlux
Comparing & Contrasting Spring WebMVC & WebFlux

- Spring WebMVC & WebFlux have similarities & differences wrt functionality & internal components

Spring MVC:
- Imperative logic, simple to write and debug
- JDBC, JPA, blocking deps

Spring WebFlux:
- @Controller
- Reactive clients
- Tomcat, Jetty, Undertow
- Functional endpoints
- Event loop concurrency model
- Netty

See maddy4java.blogspot.com/2019/11/spring-boot-spring-webflux-vs-spring-mvc.html
Comparing & Contrasting Spring WebMVC & WebFlux

- WebMVC is sync

Built on Servlet API & uses a synchronous I/O w/one-thread-per-request model
Comparing & Contrasting Spring WebMVC & WebFlux

• WebMVC is sync
• The server uses a thread-per-request, where each thread handles a single request at a time

See www.baeldung.com/spring-webflux-concurrency
Comparing & Contrasting Spring WebMVC & WebFlux

- WebFlux is async

Non-blocking I/O that leverages multiple cores & handles large # of connections

Callbacks are transparent to server code that uses Mono & Flux reactive types
Comparing & Contrasting Spring WebMVC & WebFlux

- WebFlux is async
- It uses a completely non-blocking environment that can achieve higher concurrency with better resource utilization

See [www.baeldung.com/spring-webflux-concurrency](http://www.baeldung.com/spring-webflux-concurrency)
Accessing Mono & Flux Endpoints Seamlessly
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- WebFlux Mono/Flux endpoints exchange HTTP requests/responses

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- WebFlux Mono/Flux endpoints exchange HTTP requests/responses
- WebClient or RestTemplate can send/receive HTTP requests/responses to/from reactive endpoints

```java
Flux<Airport> airports = webClient
    .get()
    .uri(baseUrl + AIRPORT
         + "/" + AIRPORTS)
    .retrieve()
    .bodyToFlux(Airport.class);

Airport[] airports = restTemplate
    .getForEntity(baseUrl + AIRPORT
                  + "/" + AIRPORTS,
                  Airport[].class)
    .getBody();
```

See [www.baeldung.com/spring-webclient-resttemplate](http://www.baeldung.com/spring-webclient-resttemplate)
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See flights-microservices/-/blob/master/src/main/java/server/flight/FlightService.java
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RestTemplate treats reactive types synchronously from the perspective of a client

However, no changes are required on the (reactive) server side
Accessing Mono & Flux Endpoints Seamlessly

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```java
Airport[] airports = restTemplate
    .getForEntity(baseUrl + AIRPORT + "/" + AIRPORTS,
                  Airport[].class)
    .getBody();

Flux<Airports> Flux.fromIterable
    (airports != null ? List.of(airports) : Collections.emptyList());
```

Easy to convert back to reactive types
Accessing Mono & Flux Endpoints Seamlessly

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Flux<Airport> airports = webClient
    .get()
    .uri(baseUrl + AIRPORT + "" + AIRPORTS)
    .retrieve()
    .bodyToFlux(Airport.class);
```

*WebClient leverages reactive types more effectively since responses are emitted as soon as they are available*

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```

WebClient also enables end-to-end asynchrony

An HTTP request is not sent until subscribe() is called (& runs in thread pool)
WebFlux Mono/Flux endpoints exchange HTTP requests/responses

WebClient or RestTemplate can send/receive HTTP requests/responses to/from reactive endpoints

JSon encoding/decoding is identical for reactive WebFlux Mono/Flux types or traditional WebMVC RefTypes/List types

GET flighthost:8081/airports

[ 
{
    "airportCode": "ALB",
    "airportName": "Albany, NY"
},
{
    "airportCode": "AMA",
    "airportName": "Amarillo, TX"
},
{
    "airportCode": "ATL",
    "airportName": "Atlanta, GA"
}, ...
Accessing Mono & Flux Endpoints Seamlessly

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- JSON encoding/decoding is identical for reactive WebFlux Mono/Flux types or traditional WebMVC RefTypes/List types

- Tools like Postman can thus work seamlessly with either

See www.postman.com
End of Overview of Spring WebMVC & WebFlux