

Intro to Spring Boot Reactive Stack

What is the Reactive Stack?

Spring Boot's **Reactive Stack** is designed for building **non-blocking**, **asynchronous**, and **event-driven** applications. It helps in efficiently handling **concurrent I/O operations** — perfect for microservices, streaming apps, and APIs that need to scale.

Core Modules:

- **Spring WebFlux**: Reactive alternative to Spring MVC.
- **Reactor**: Foundation library for reactive programming.
- **Netty**: Default reactive HTTP server (instead of Tomcat).
- **R2DBC**: Reactive Database access (alternative to JDBC).

Key Benefits:

- Handles thousands of concurrent connections.
- Lower memory footprint.
- Backpressure-aware (can handle load effectively).

Reactive Streams & Reactor

Reactive Streams (Spec)

A standard for asynchronous stream processing with **non-blocking backpressure**. Interfaces:

- **Publisher<T>**: Emits data.
- **Subscriber<T>**: Consumes data.
- **Subscription**: Manages flow.
- **Processor**: Combines publisher & subscriber.
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Project Reactor (by Spring)

An implementation of Reactive Streams used in Spring WebFlux.

Core types:

- **Mono<T>** – Emits 0 or 1 item (like Optional).
- **Flux<T>** – Emits 0 to N items (like a Stream).

Example:

```
Mono<String> mono = Mono.just("Hello");  
Flux<Integer> flux = Flux.range(1, 5);
```

Features:

- Operators: map(), flatMap(), filter(), etc.
 - Thread control via subscribeOn(), publishOn().
 - Built-in backpressure support.
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Data Access with R2DBC

What is R2DBC?

Reactive Relational Database Connectivity – an API to interact with SQL databases reactively (non-blocking), as an alternative to **JDBC**.

Key Concepts:

- Doesn't use blocking database drivers.
- Built for integration with reactive frameworks like WebFlux.
- Works with PostgreSQL, MySQL, SQL Server, H2, etc.

Key Tools:

- **spring-boot-starter-data-r2dbc** – Enables Spring Data R2DBC.

- **r2dbc-postgresql** – PostgreSQL reactive driver.
- **DatabaseClient** – Low-level reactive SQL executor.
- **R2dbcRepository** – Interface-based reactive repositories (similar to JpaRepository).