Servlet vs Reactive
Choosing the Right Stack

Rossen Stoyanchev

This talk

Servlet and Reactive stacks

Spring Framework 5

Big shift towards async

Learn about the options, make choices

About me

Spring Framework committer

Web development

Spring WebFlux from inception to GA

Pivotal®

Ask Me Anything

(immediately after this session)

Also featuring:

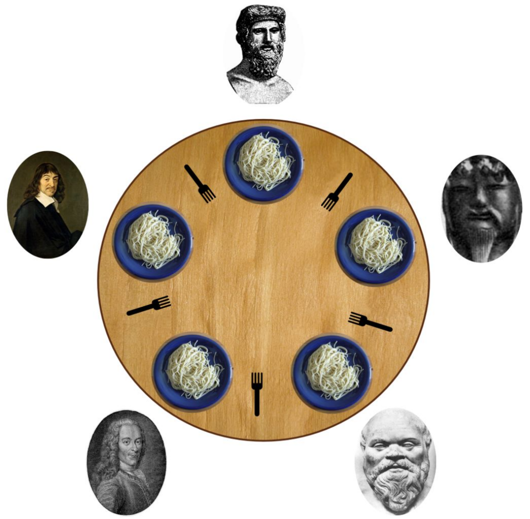
Phil Webb → Spring Boot lead

Stephane Maldini → Reactor lead

Motivation for change

REACTIVE
REACTIVE, EVERYWHERE ??

Asynchronicity



Thread pools

Asynchronicity

Actors

Fibers / Project Loom

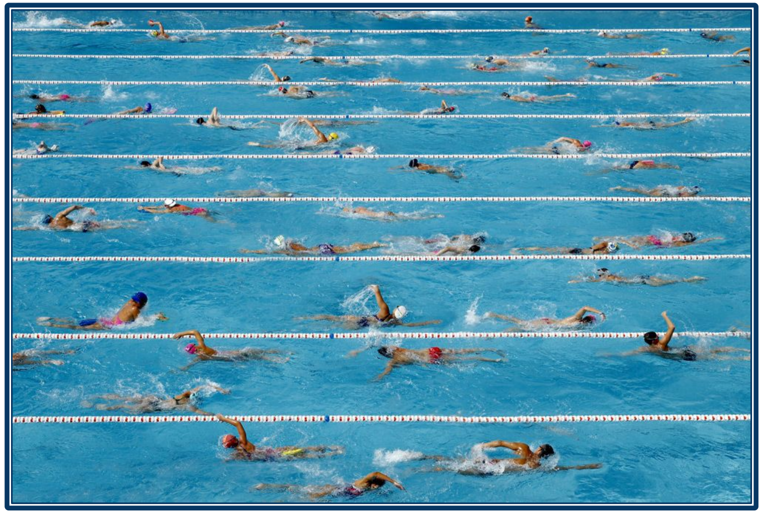
Coroutines

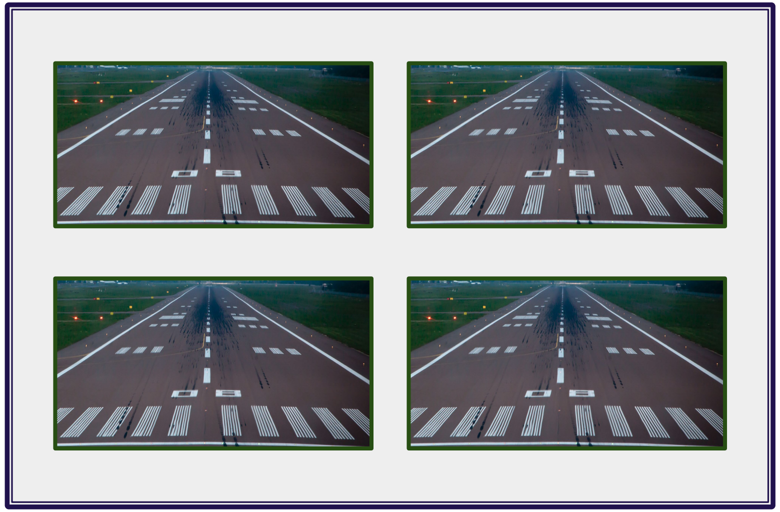
Event loop

Thread pools

Servlet

Reactive

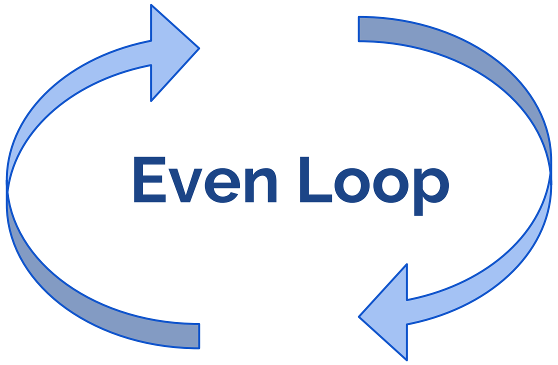




100s, 1000s threads
(blocked)

Small, fixed # of threads
(running)

Non-blocking concurrency



Declarative composition of asynchronous logic

CompletableFuture, ReactiveX, Reactor, …

Java 8 lambdas
Functional programming models

Stack choices

and why choice matters

@Controller

Servlet

@Controller

Reactive

Reactive client

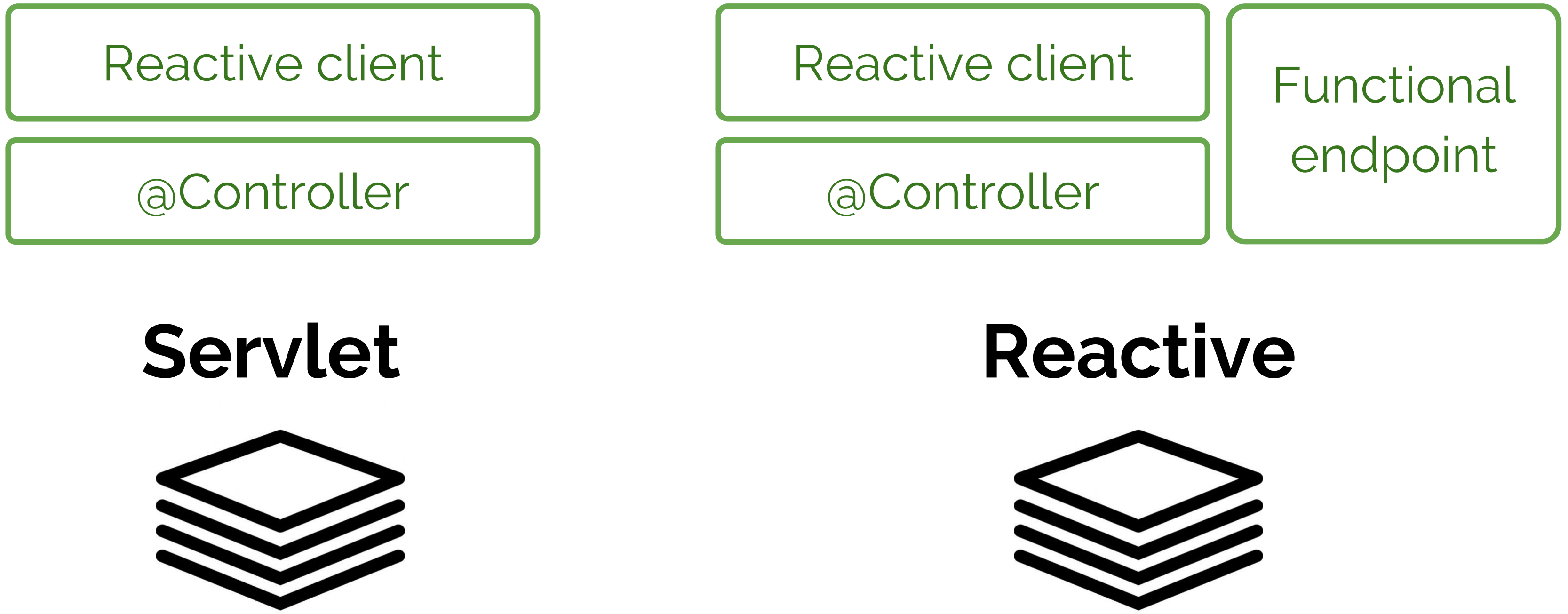
@Controller

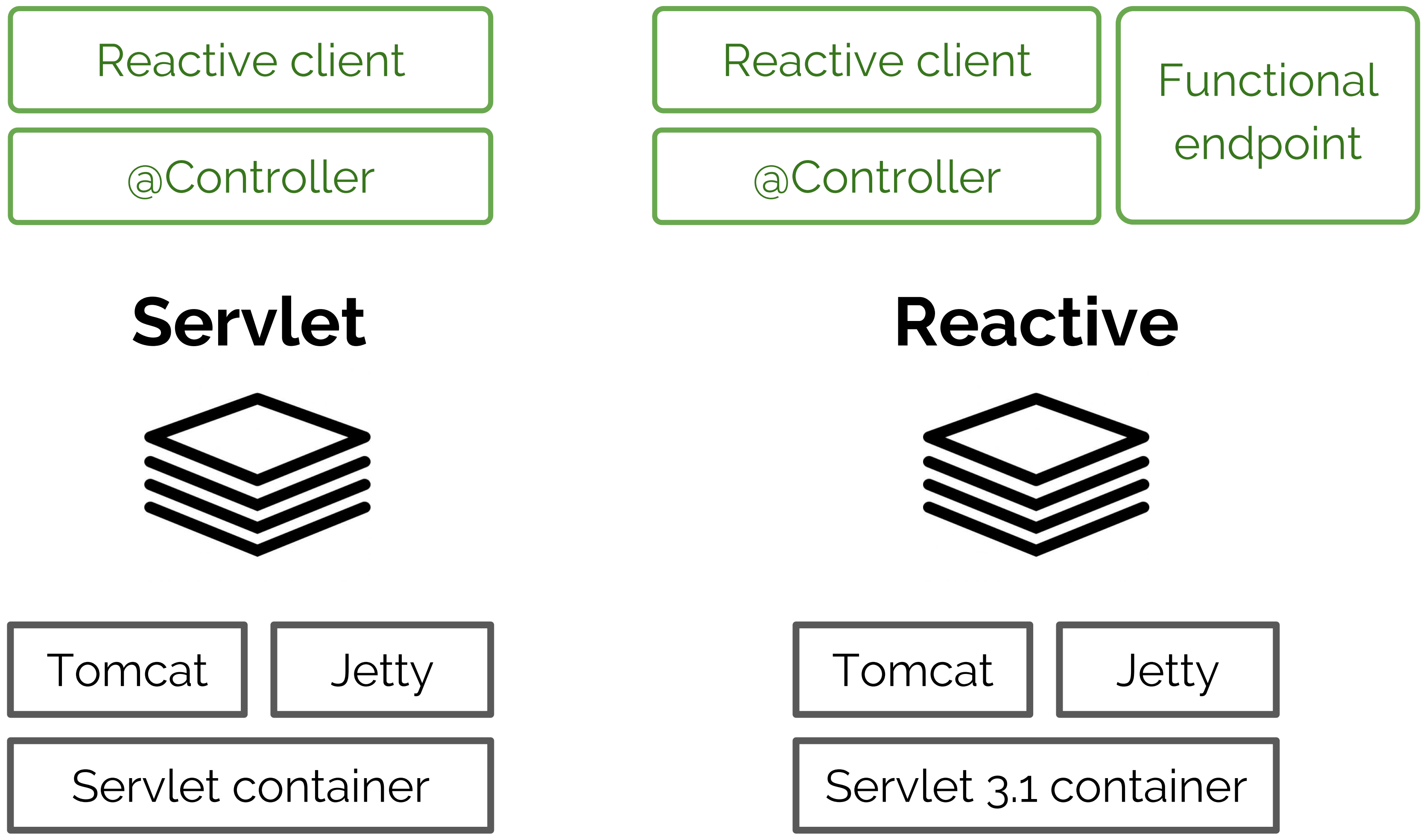
Servlet

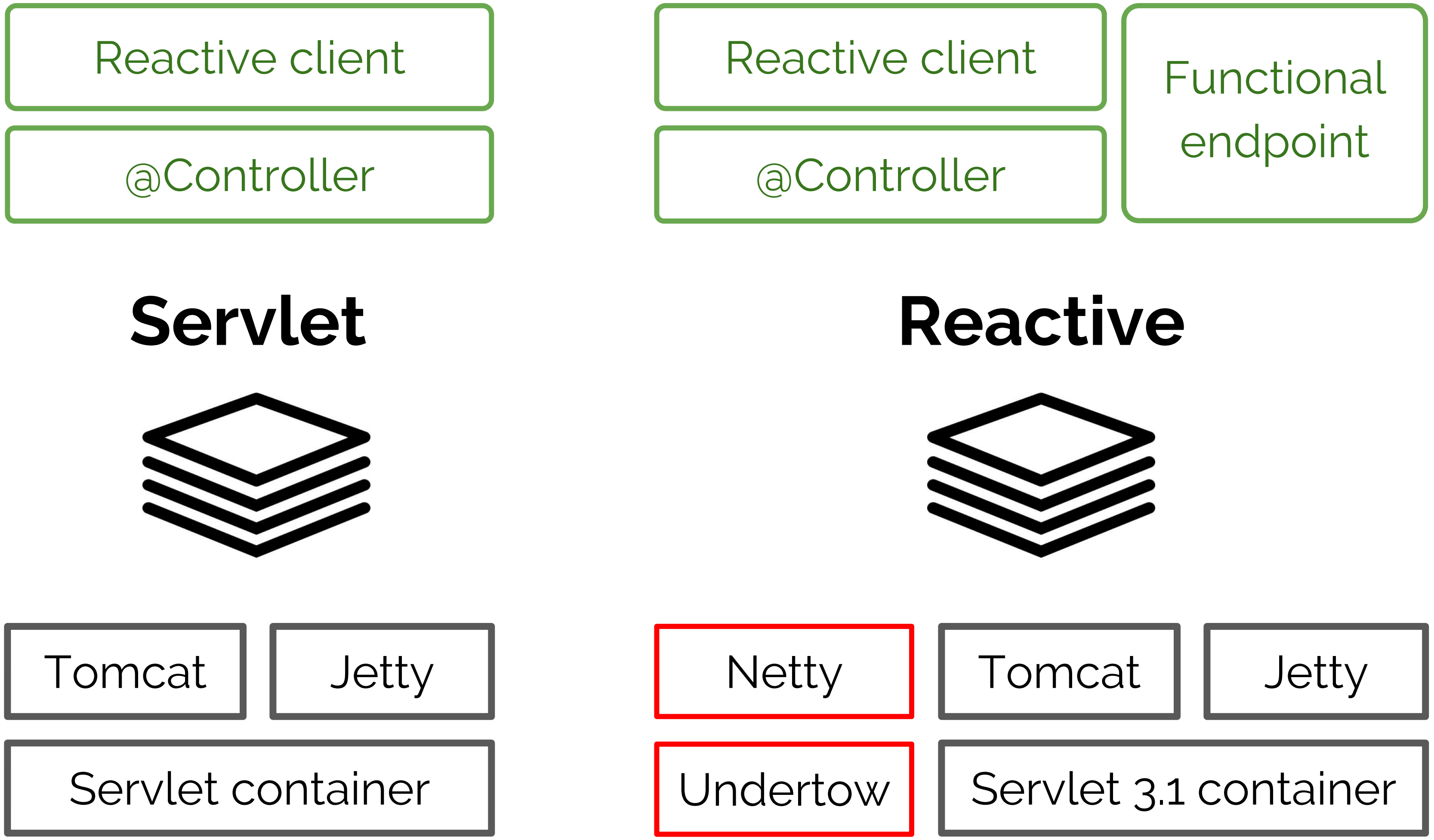
Reactive client

@Controller

Reactive

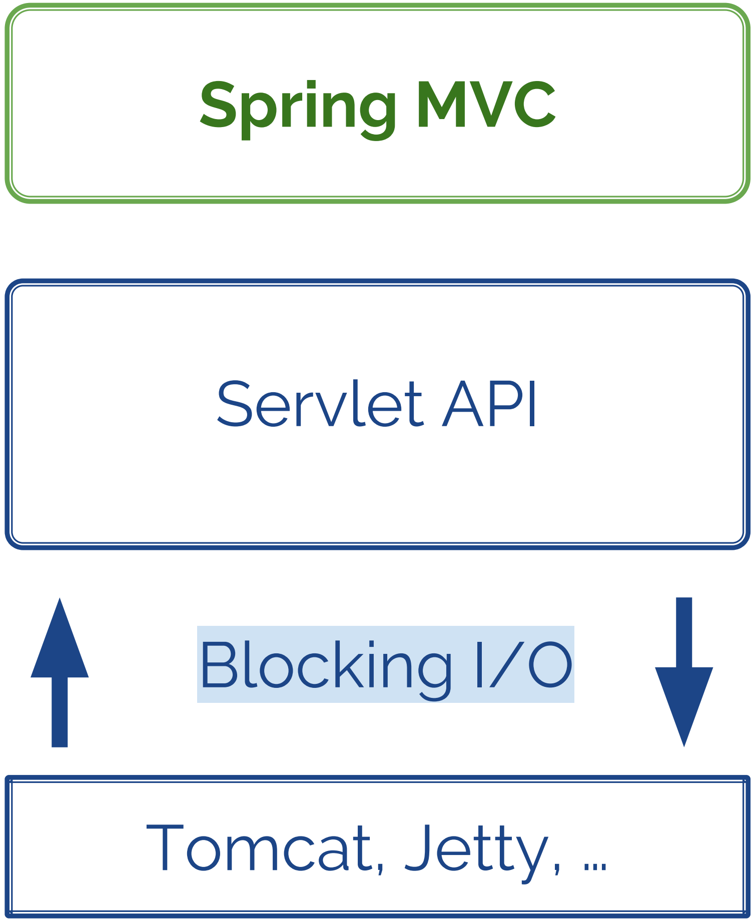

Reactive client
@Controller
Servlet
Reactive client
@Controller
Functional endpoint
Reactive


Reactive client
@Controller
Servlet
Tomcat
Jetty
Servlet container
Reactive client
@Controller
Functional endpoint
Reactive
Tomcat
Jetty
Servlet 3.1 container


Reactive client
@Controller
Servlet
Tomcat
Jetty
Servlet container
Reactive client
@Controller
Functional endpoint
Reactive
Netty
Tomcat
Jetty
Undertow
Servlet 3.1 container

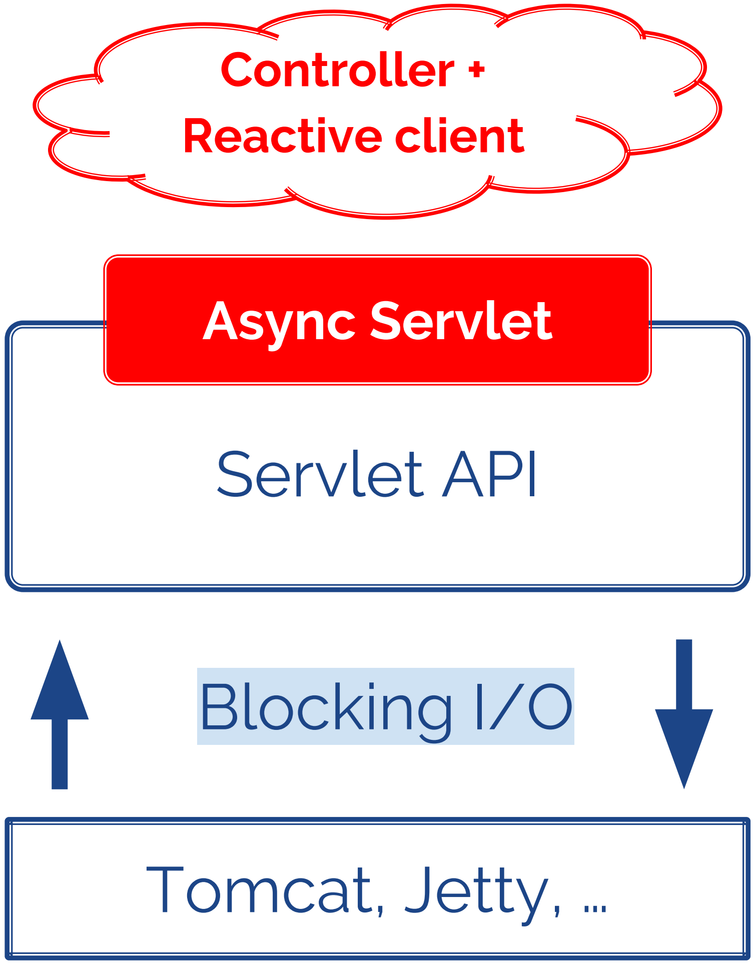
Demo

Stack architecture


Spring MVC
Servlet API
Blocking I/O
Tomcat, Jetty, …

History of Servlet API

1997	1.0	
...	...	
2009	3.0	Async Servlet
2009	3.1	Servlet non-blocking I/O
...	...	


Controller +
Reactive client
Async Servlet
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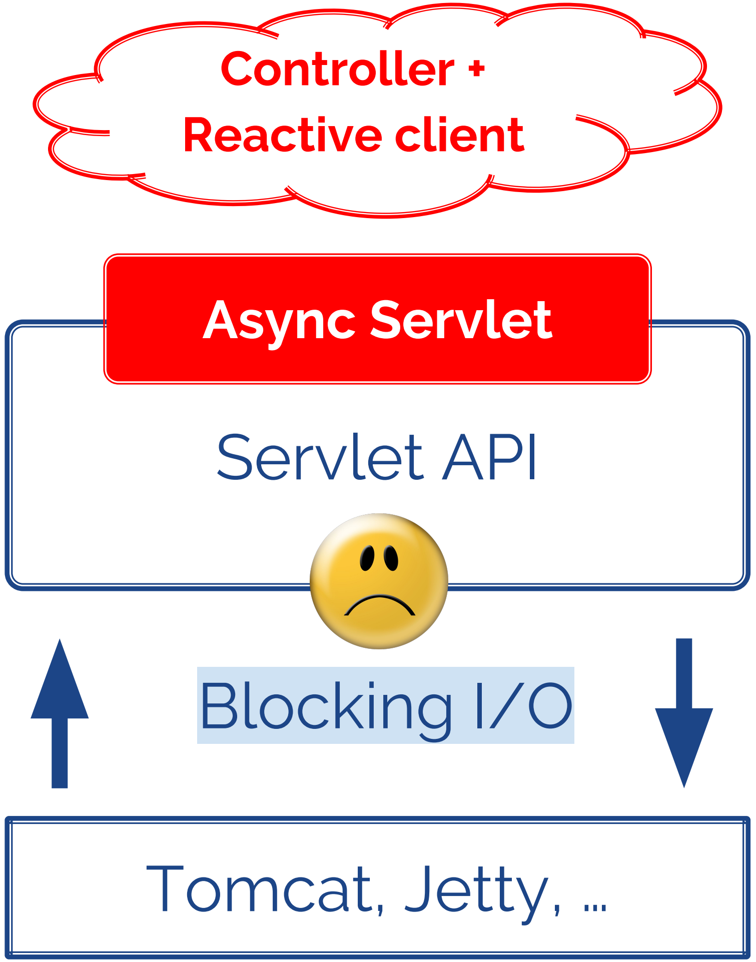
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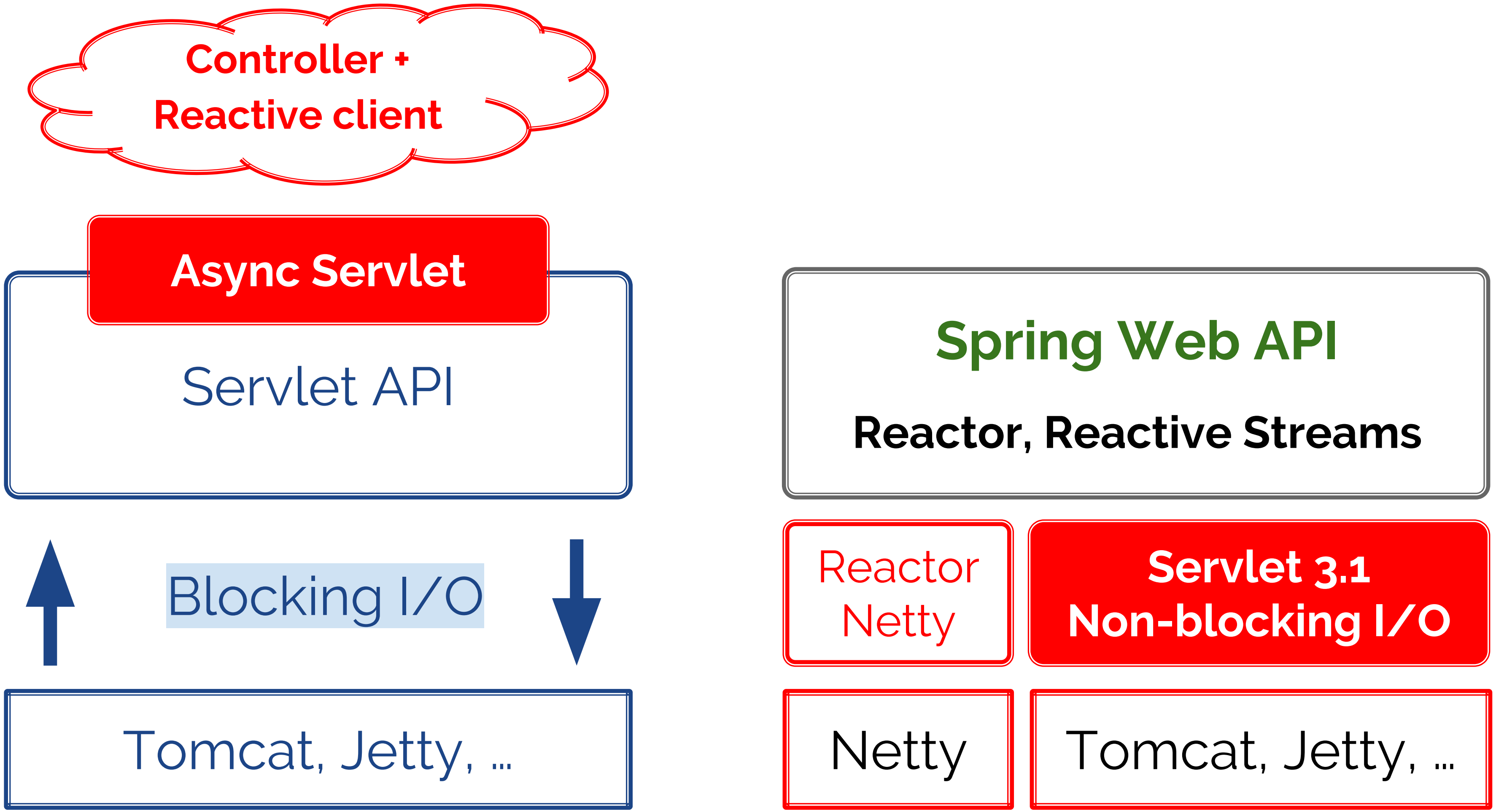
Controller +
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Async Servlet
Servlet API
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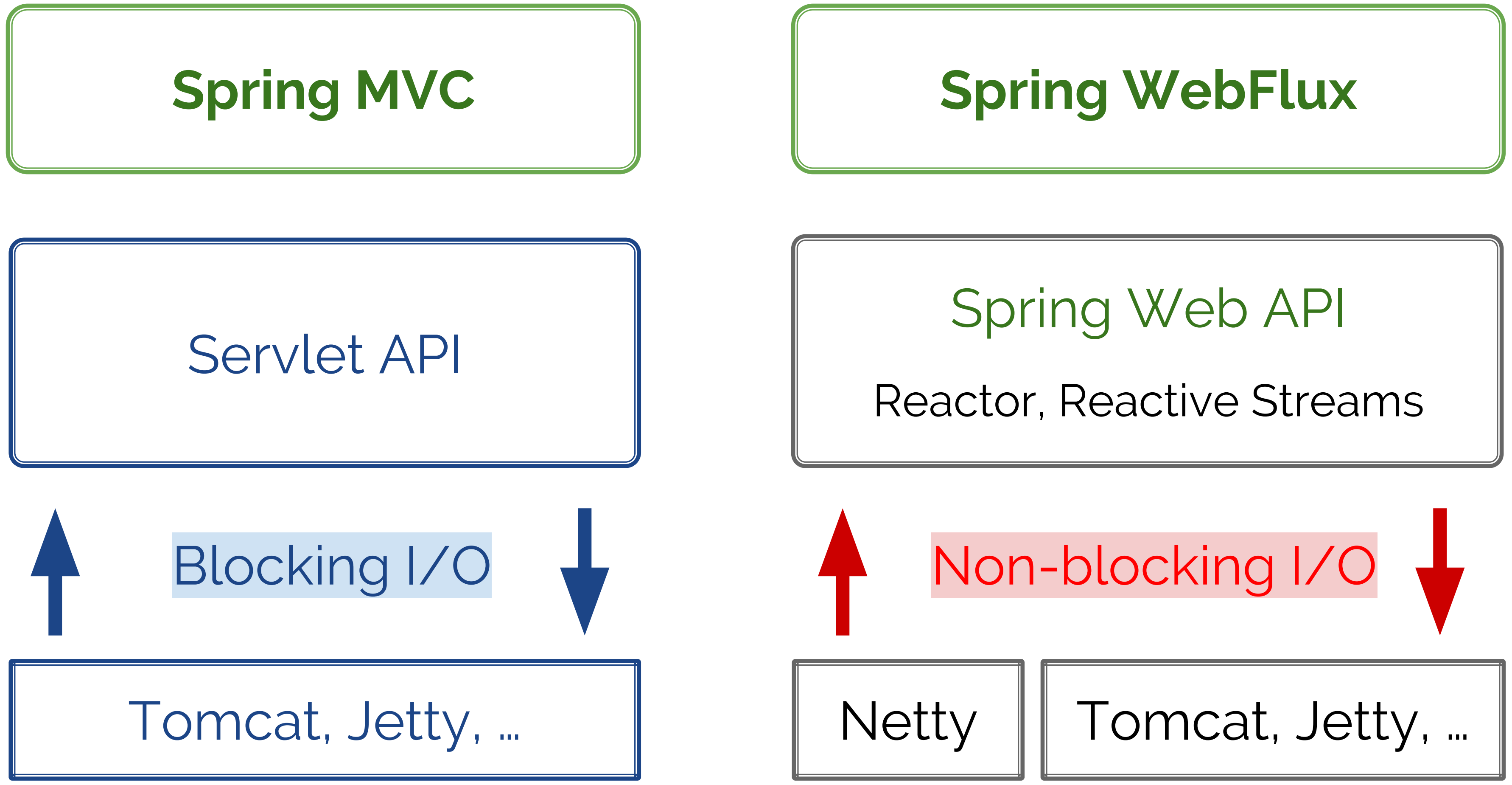
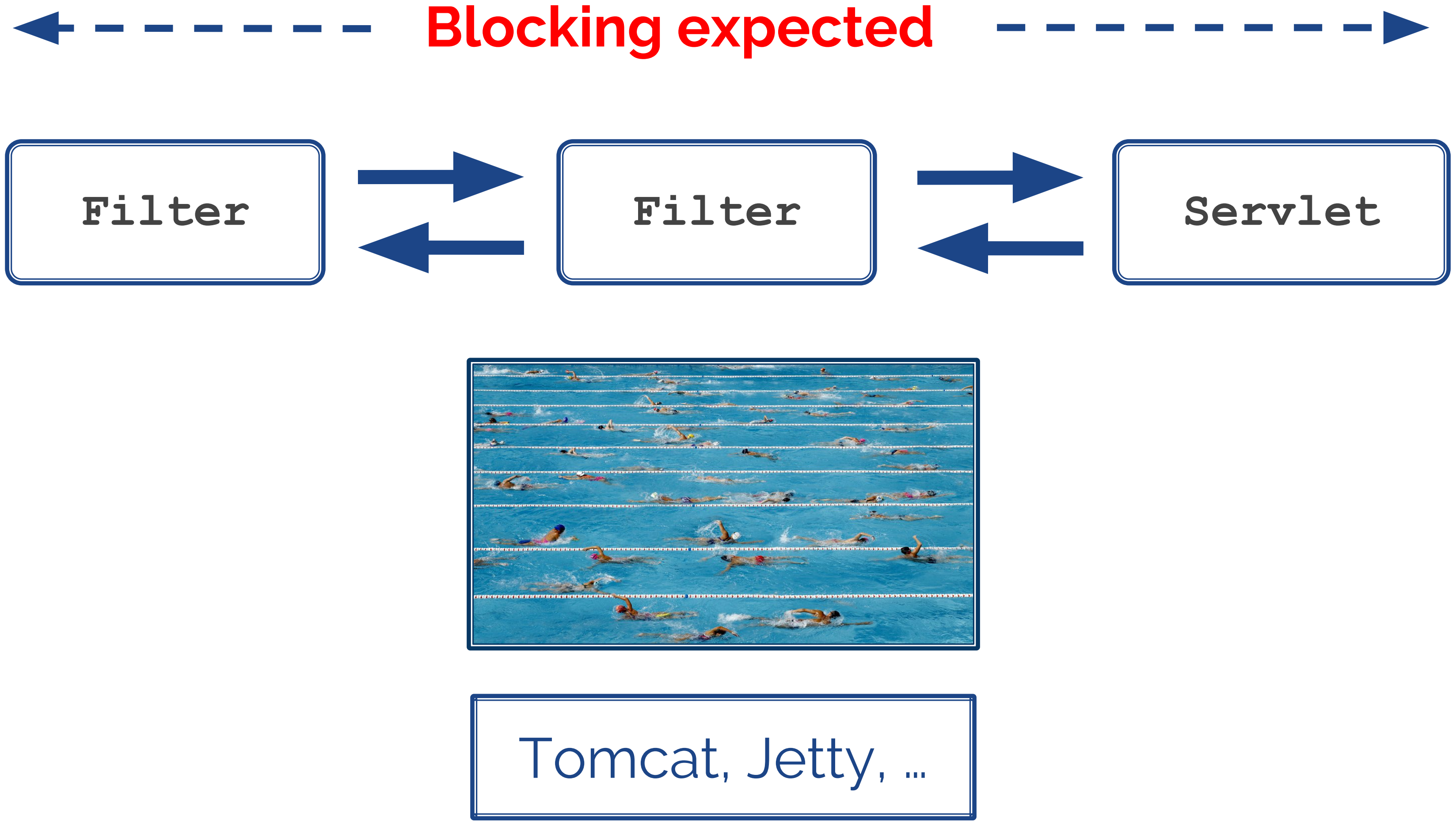
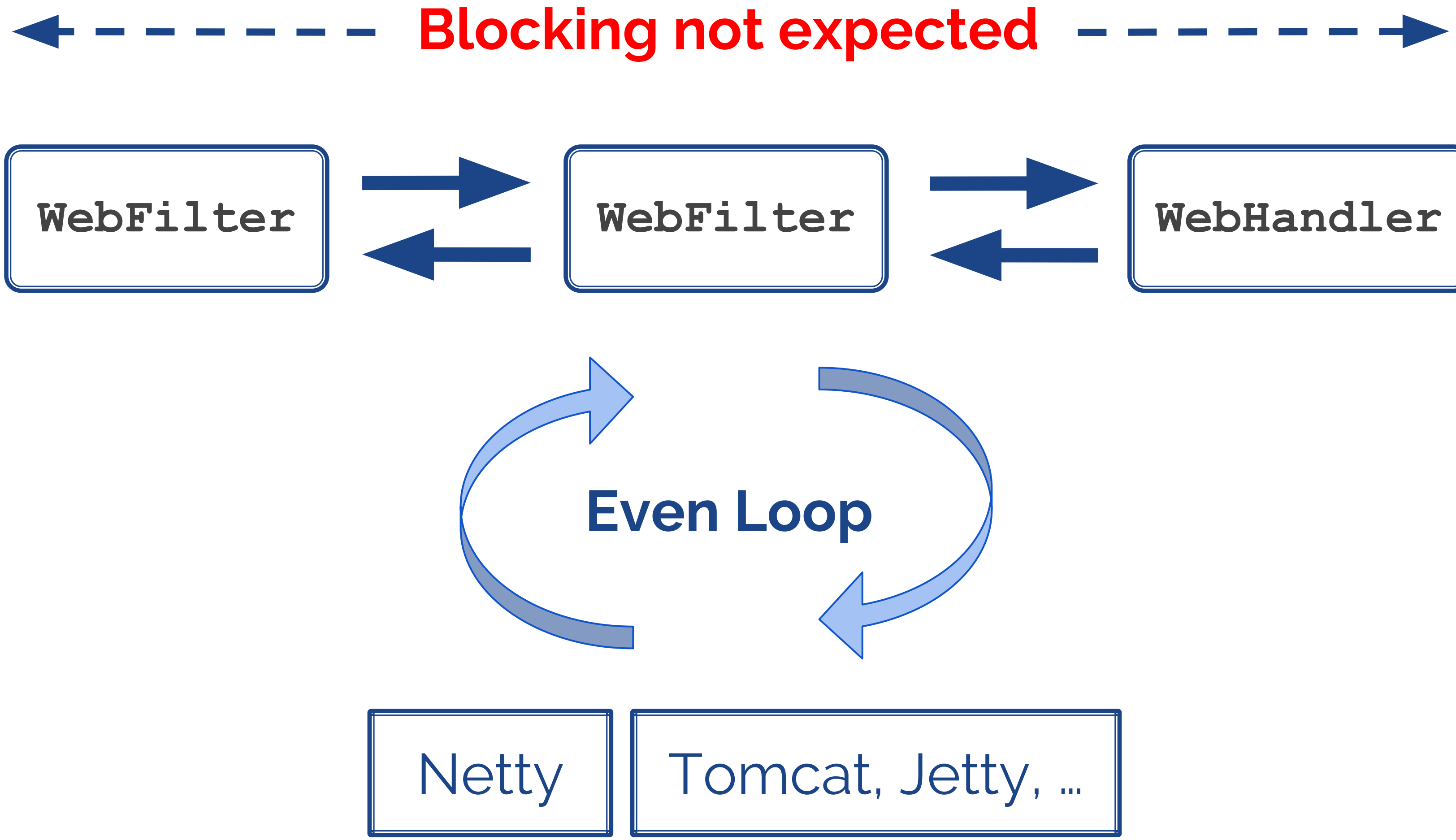
Tomcat, Jetty, ...
Spring Web API
Reactor, Reactive Streams
Reactor
Netty
Servlet 3.1
Non-blocking I/O
Netty
Tomcat, Jetty, ...


Spring MVC
Servlet API
Blocking I/O
Tomcat, Jetty, …
Spring WebFlux
Spring Web API
Reactor, Reactive Streams
Non-blocking I/O
Netty
Tomcat, Jetty, …

Reactive, non-blocking back pressure


Blocking expected
Filter
Filter
Servlet
Tomcat, Jetty, …


Blocking not expected
WebFilter
WebFilter
WebHandler
Even Loop
Netty
Tomcat, Jetty, ...

```
WebFilter, WebHandler
Mono<Void>
```

Request

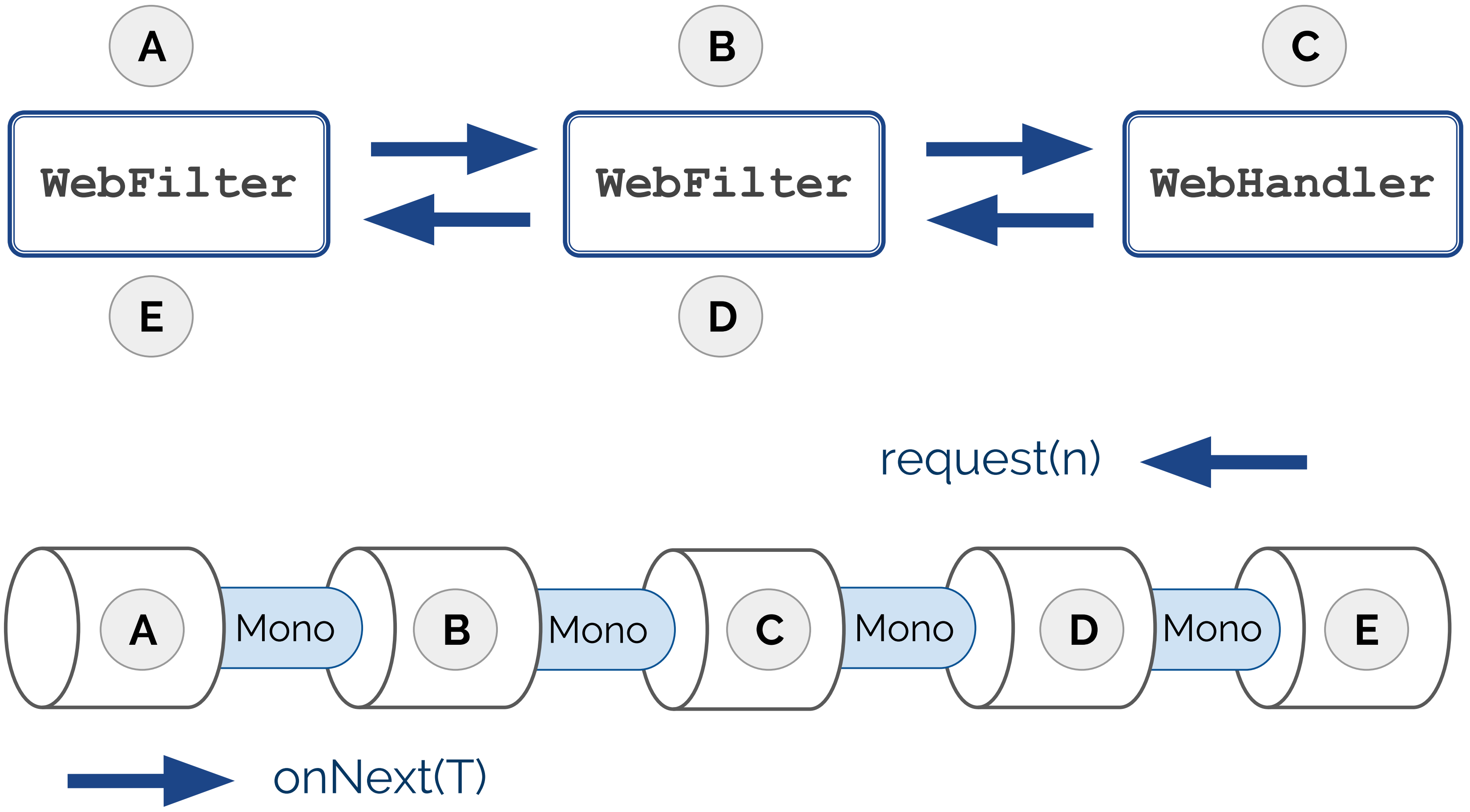
```
Flux<DataBuffer> getBody()
```

Response

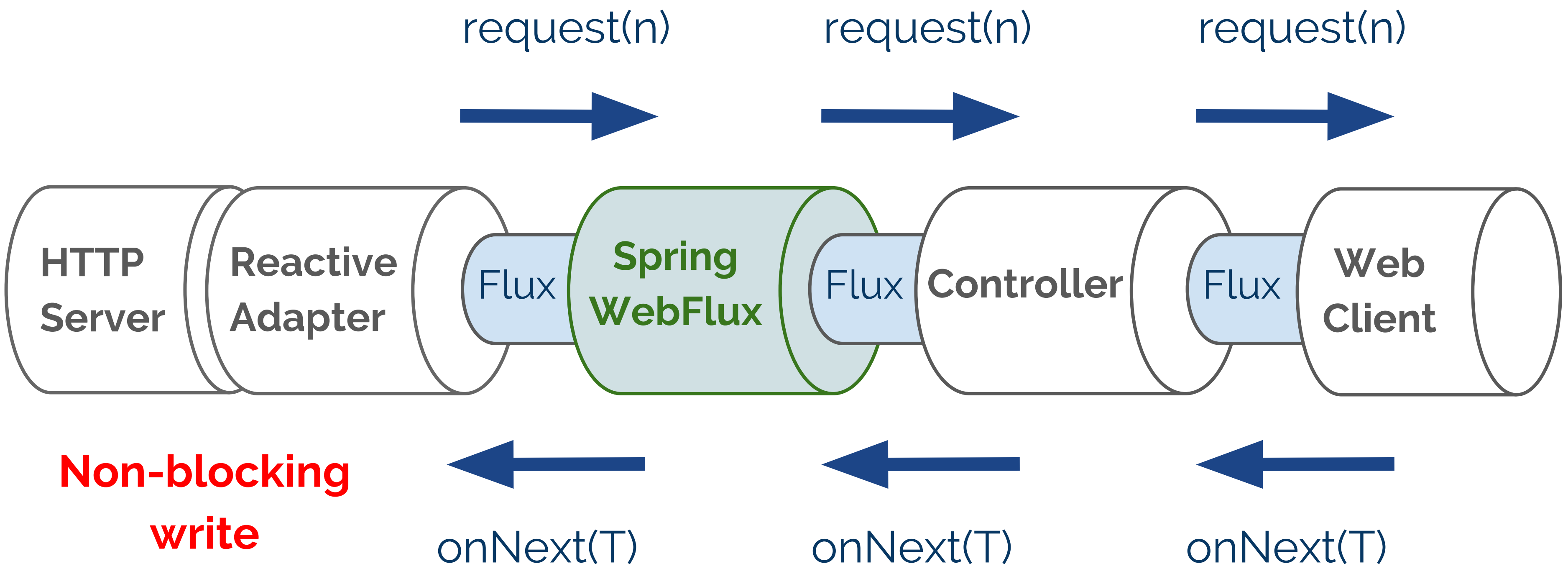
```
writeWith(Flux<DataBuffer>)
```

Codecs

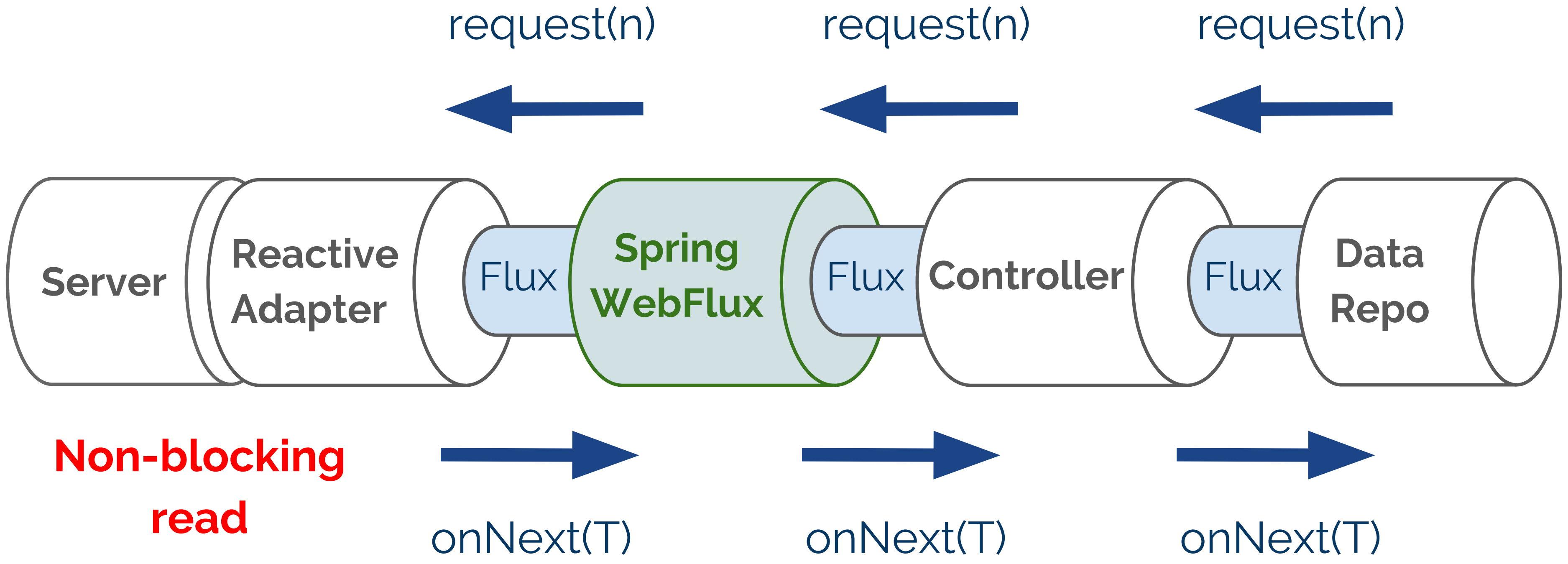
$$\texttt{Flux<DataBuffer>} \Longleftrightarrow \texttt{Flux<T>}$$


A
B
C
WebFilter
WebFilter
WebHandler
E
D
request(n)
A
Mono
B
Mono
C
Mono
D
Mono
E
onNext(T)

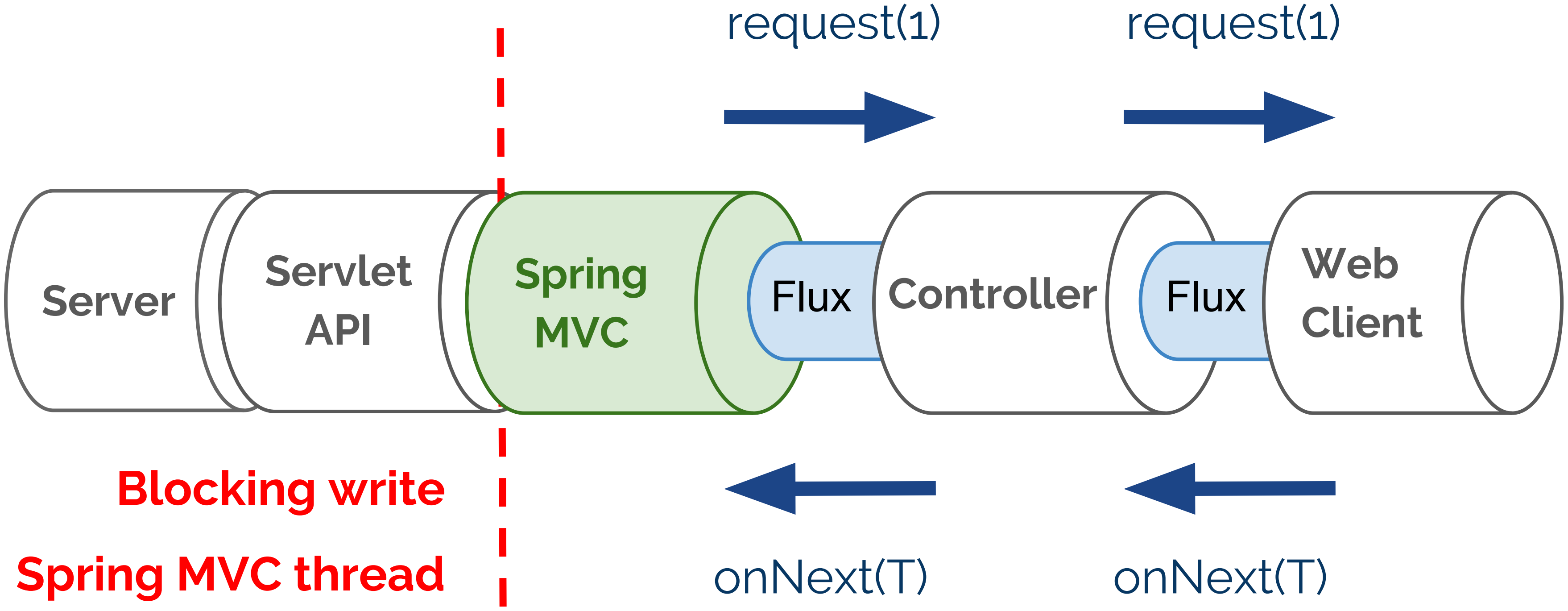
WebFlux Response



WebFlux Request



Spring MVC Response



Demo

Choosing

The right stack for the job at hand

Spring MVC

If it ain’t broken, don’t fix it

Imperative logic is the easiest to write and debug

Check application dependencies (JDBC, JPA)

Spring MVC + Reactive Client

Compose **remote service calls**

Reactive data (Mongo, Cassandra, Redis)

Response **stream**

Spring WebFlux

Use cases → easy to stream up or down

Scale → efficient at I/O

Programming model → functional endpoints

Spring WebFlux Performance

Efficient scale with less hardware resources

It’s not about speed

Latency is key to exhibit differences

Thank You

https://github.com/rstoyanchev/demo-reactive-spring

rstoya05