

The background features a large, semi-transparent watermark of the Spring Framework logo, which consists of a stylized leaf or drop shape with a circular element inside.

Spring Framework 5 Themes & Trends

Preparing for 2017+

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Spring Framework 4.3

- **Last 4.x feature release!**
- **Generally available since June 2016**

- **Extended support life until 2019**
 - on JDK 6, 7, 8
 - on Tomcat 6, 7, 8.0, 8.5
 - on WebSphere 7, 8.0, 8.5 and 9

- **Programming model refinements brought forward to JDK 6+**
 - DI & MVC refinements
 - composed annotations

The State of the Art: Component Classes

```
@Service
@Lazy
public class MyBookAdminService implements BookAdminService {

    // @Autowired
    public MyBookAdminService(AccountRepository repo) {
        ...
    }

    @Transactional
    public BookUpdate updateBook(Addendum addendum) {
        ...
    }
}
```

Configuration Classes with Autowired Constructors

```
@Configuration
```

```
public class MyBookAdminConfig {
```

```
    private final DataSource bookAdminDataSource;
```

```
    // @Autowired
```

```
    public MyBookAdminConfig(DataSource bookAdminDataSource) {
```

```
        this.bookAdminDataSource = bookAdminDataSource;
```

```
    }
```

```
@Bean
```

```
public BookAdminService myBookAdminService() {
```

```
    MyBookAdminService service = new MyBookAdminService();
```

```
    service.setDataSource(this.bookAdminDataSource);
```

```
    return service;
```

```
}
```

```
}
```

Annotated MVC Controllers

```
@Controller
```

```
@CrossOrigin
```

```
public class MyRestController {
```

```
    @RequestMapping(path="/books/{id}", method=GET)
```

```
    public Book findBook(@PathVariable long id) {  
        return this.bookAdminService.findBook(id);  
    }
```

```
    @RequestMapping(path="/books/new", method=POST)
```

```
    public void newBook(@Valid Book book) {  
        this.bookAdminService.storeBook(book);  
    }
```

```
}
```

Precomposed Annotations for MVC Controllers

```
@RestController
```

```
@CrossOrigin
```

```
public class MyRestController {
```

```
    @GetMapping("/books/{id}")
```

```
    public Book findBook(@PathVariable long id) {  
        return this.bookAdminService.findBook(id);  
    }
```

```
    @PostMapping("/books/new")
```

```
    public void newBook(@Valid Book book) {  
        this.bookAdminService.storeBook(book);  
    }
```

```
}
```

Spring Framework 5

- **A new application framework generation for 2017+**
- **5.0 RC2 out soon; GA expected in July**
- **5.1 to follow in early 2018**

- **Major baseline upgrade**
 - JDK 8+, Servlet 3.1+, JPA 2.1+, JMS 2.0+
 - support for JUnit 5 (next to JUnit 4.12)

- **Key infrastructure themes**
 - JDK 9, Jigsaw, HTTP/2, Servlet 4, Kotlin
 - functional style and reactive architectures

JDK 9

HTTP/2

Functional

Reactive

JDK 9: Not Just Jigsaw

- **Many general JVM improvements**
 - Compact Strings, G1 by default, TLS protocol stack
- **Jigsaw – module path as structured alternative to class path**
 - symbolic module names and requires/exports metadata for jar files
- **JDK 9 GA scheduled for September 2017**
 - Spring 5 is fully aligned in terms of JDK 9's policies and constraints
- **For a smooth immediate upgrade, stay in class path mode!**
 - Spring 4.3 & 5.0 are generally compatible with JDK 9 out of the box

Using Jigsaw with Spring

- **Framework jars as Jigsaw-compliant modules on the module path**
 - internally declaring module-info for each jar (in consideration for 6.0)
 - or as “automatic modules” (for the time being in 4.3 & 5.x)
- **Separate module namespace, following Maven Central jar naming**
 - spring-context, spring-jdbc, spring-webmvc
- **An application's module-info.java may refer to framework modules**

```
module my.app.db {  
    requires spring.jdbc;  
}
```

JDK 9

HTTP/2

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Reactive

The Importance of HTTP/2 (RFC 7540)

■ Enormous benefits over HTTP 1.1 (1997 → 2017)

- binary protocol
- TLS (SSL) everywhere
- connection multiplexing
- headers compression
- request prioritization
- push of correlated resources

■ Browsers already implement HTTP/2 over TLS

- major websites work with HTTP/2 already: Google, Twitter, etc
- *We need to embrace it in Java land as well!*

Spring 5 and HTTP/2

- **Servlet 4.0 specification expected to go final in July 2017**
 - enforces support for HTTP/2 in Servlet containers
 - new PushBuilder API for pushing additional resources to a client
- **Native HTTP/2 support in current Servlet 3.1 containers**
 - Tomcat 8.5 / 9.0, Jetty 9.3 / 9.4, Undertow 1.3 / 1.4
 - special setup for ALPN on JDK 8 (comes out of the box in JDK 9)
- **Let's enable HTTP/2 as soon as possible...**
 - Spring's focus: native HTTP/2 on top of Tomcat / Jetty / Undertow
 - smooth upgrade to Servlet 4.0 containers once available

JDK 9

HTTP/2

Functional

Reactive

Functional Style vs Annotation Style

- **Spring 4.3 wraps up a well-established annotation story**
 - a comprehensive annotation-based component model
 - with loosely coupled, self-descriptive endpoint classes

- **Spring 5 provides functional-style APIs as an alternative**
 - programmatic bean registration and endpoint composition
 - no need for annotations or scanning, even avoiding reflection

- **First-class support for the Kotlin language out of the box**
 - Java 8 is a fine foundation for functional-style Java APIs
 - Spring's Kotlin extensions make code even more concise

Programmatic Bean Registration with Java 8

```
// Starting point may also be AnnotationConfigApplicationContext
GenericApplicationContext ctx = new GenericApplicationContext();
ctx.registerBean(Foo.class);
ctx.registerBean(Bar.class,
    () -> new Bar(ctx.getBean(Foo.class)));
```

```
// Or alternatively with some bean definition customizing
GenericApplicationContext ctx = new GenericApplicationContext();
ctx.registerBean(Foo.class, Foo::new);
ctx.registerBean(Bar.class,
    () -> new Bar(ctx.getBean(Foo.class),
    bd -> bd.setLazyInit(true));
```


Programmatic Bean Registration with Kotlin

```
// Java-style usage of Spring's Kotlin extensions
val ctx = GenericApplicationContext()
ctx.registerBean(Foo::class)
ctx.registerBean { Bar(it.getBean(Foo::class)) }
```

```
// Gradle-style usage of Spring's Kotlin extensions
val ctx = GenericApplicationContext {
    registerBean<Foo>()
    registerBean { Bar(it.getBean<Foo>()) }
}
```

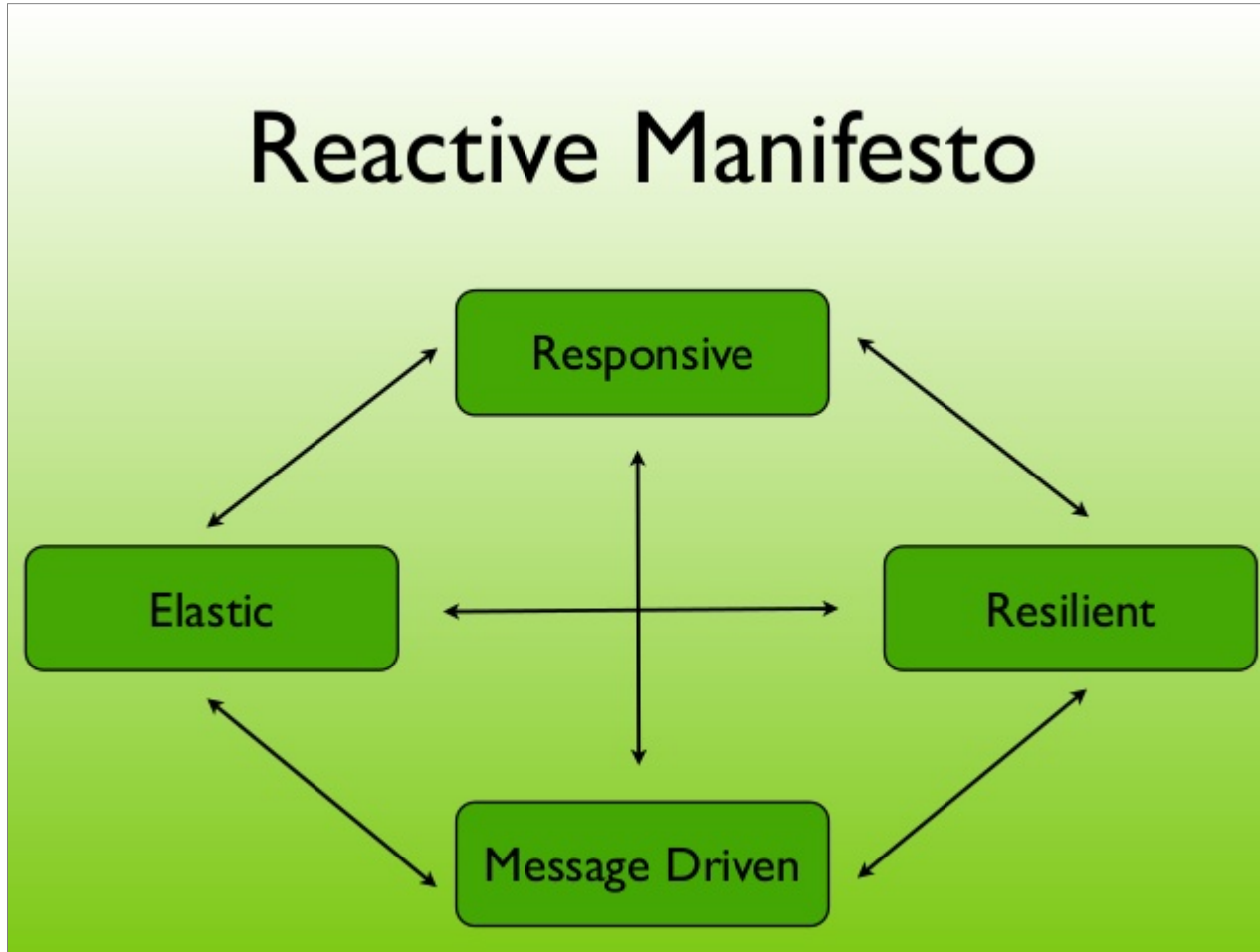
JDK 9

HTTP/2

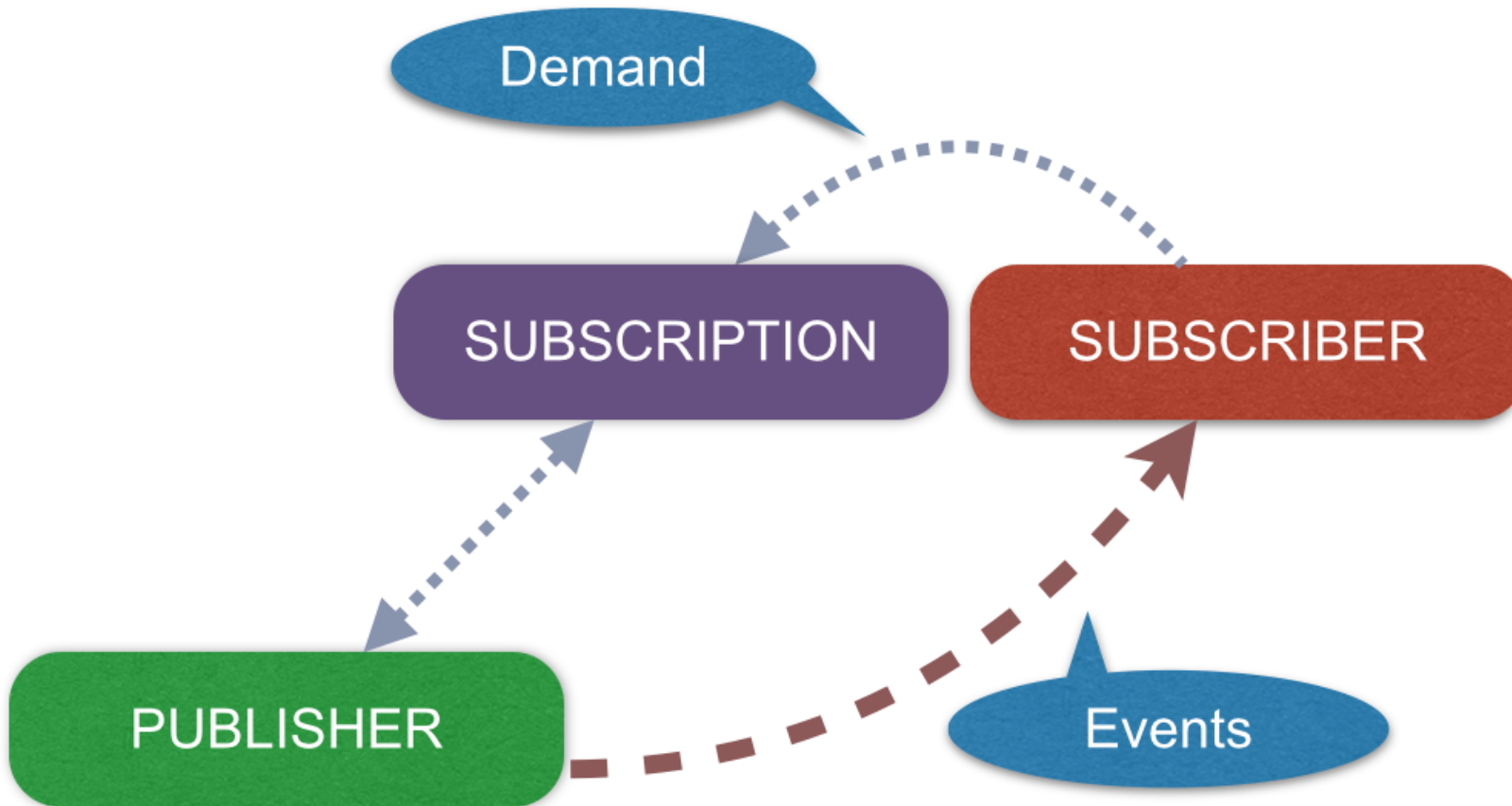
Functional

Reactive

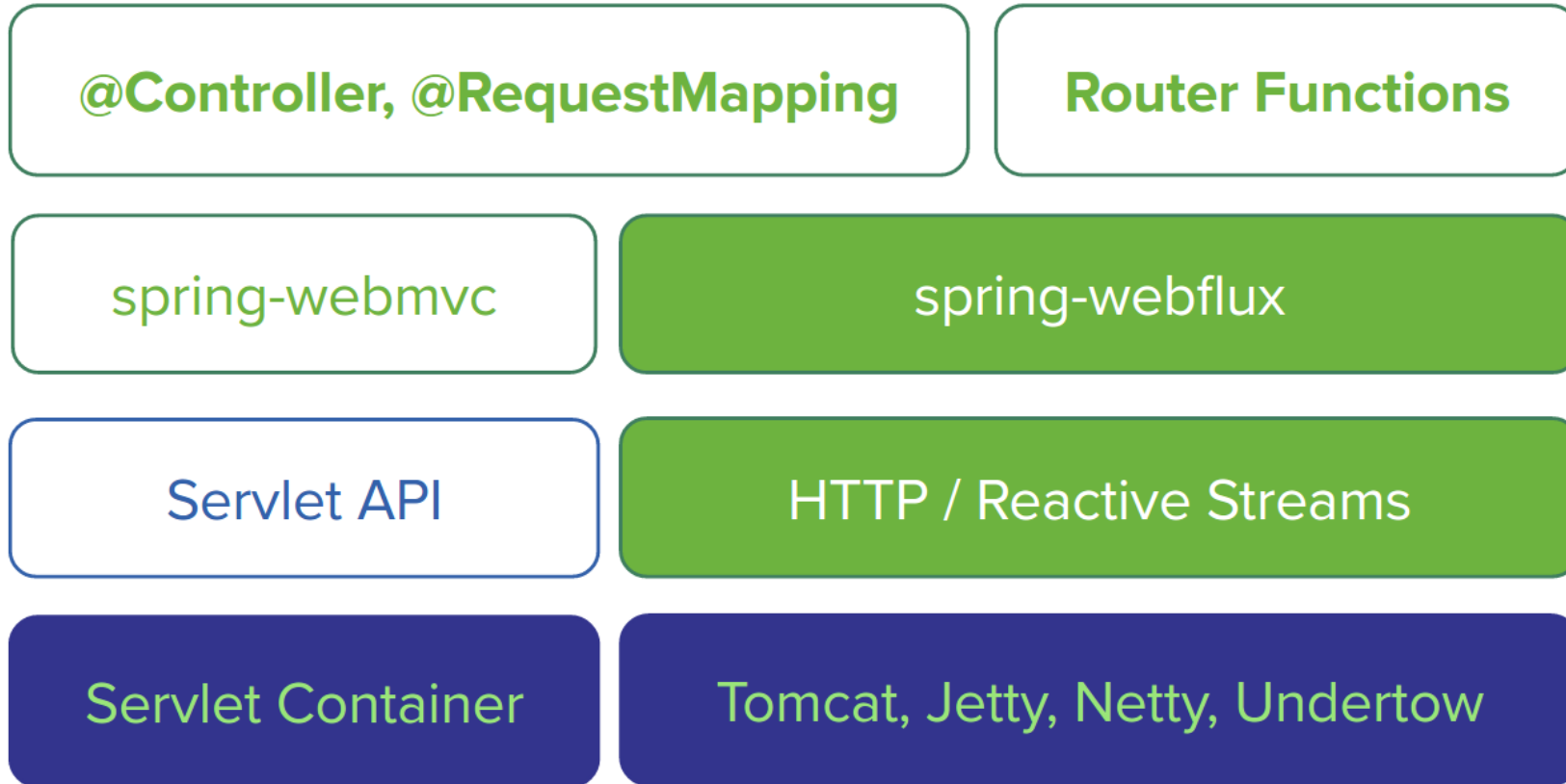
The Importance of Reactive Architectures



Reactor 3: Reactive Streams with Backpressure



Spring MVC on Servlets ↔ Spring WebFlux on Reactor



Reactive Web Controller with Repository Interop

```
@Controller
public class MyReactiveWebController {

    private final UserRepository repository;

    public MyReactiveWebController(UserRepository repository) {
        this.repository = repository;
    }

    @GetMapping("/users/{id}")
    public Mono<User> getUser(@PathVariable Long id) {
        return this.repository.findById(id);
    }

    @GetMapping("/users")
    public Flux<User> getUsers() {
        return this.repository.findAll();
    }
}
```

Functional Web Endpoints with Method References

```
RouterFunction<?> router =  
    route(GET("/users/{id}"), handlerDelegate::getUser)  
    .andRoute(GET("/users"), handlerDelegate::getUsers);
```

```
public class MyReactiveHandlerDelegate {  
    ...  
  
    public Mono<ServerResponse> getUser(ServerRequest request) {  
        Mono<User> user = Mono.justOrEmpty(request.pathVariable("id"))  
            .map(Long::valueOf).then(this.repository::findById);  
        return ServerResponse.ok().body(user, User.class);  
    }  
  
    public Mono<ServerResponse> getUsers(ServerRequest request) {  
        Flux<User> users = this.repository.findAll();  
        return ServerResponse.ok().body(users, User.class);  
    }  
}
```

Functional Web Endpoints in Lambda Style

```
UserRepository repository = ...;
```

```
RouterFunction<?> router =  
    route(GET("/users/{id}"),  
        request -> {  
            Mono<User> user = Mono.justOrEmpty(request.pathVariable("id"))  
                .map(Long::valueOf) .then(repository::findById);  
            return ServerResponse.ok().body(user, User.class);  
        })  
    .andRoute(GET("/users"),  
        request -> {  
            Flux<User> users = repository.findAll();  
            return ServerResponse.ok().body(users, User.class);  
        });
```


JDK 9

HTTP/2

Functional

Reactive

Spring Framework 5.0

RC2 out soon!

JDK 8 baseline

early support for JDK 9 & Servlet 4

functional style: Java 8, Kotlin

reactive web endpoint model

Consider reactive datastores: Spring Data “Kay” M4 out soon!

built on Spring Framework 5.0
reactive repository model
Mongo, Cassandra, Redis, etc

Stay tuned for...

Spring Boot 2.0!

M2 out soon!

built on Spring Framework 5.0
dependency baseline upgrade
reactive web starters