Business Logic and Spring Framework

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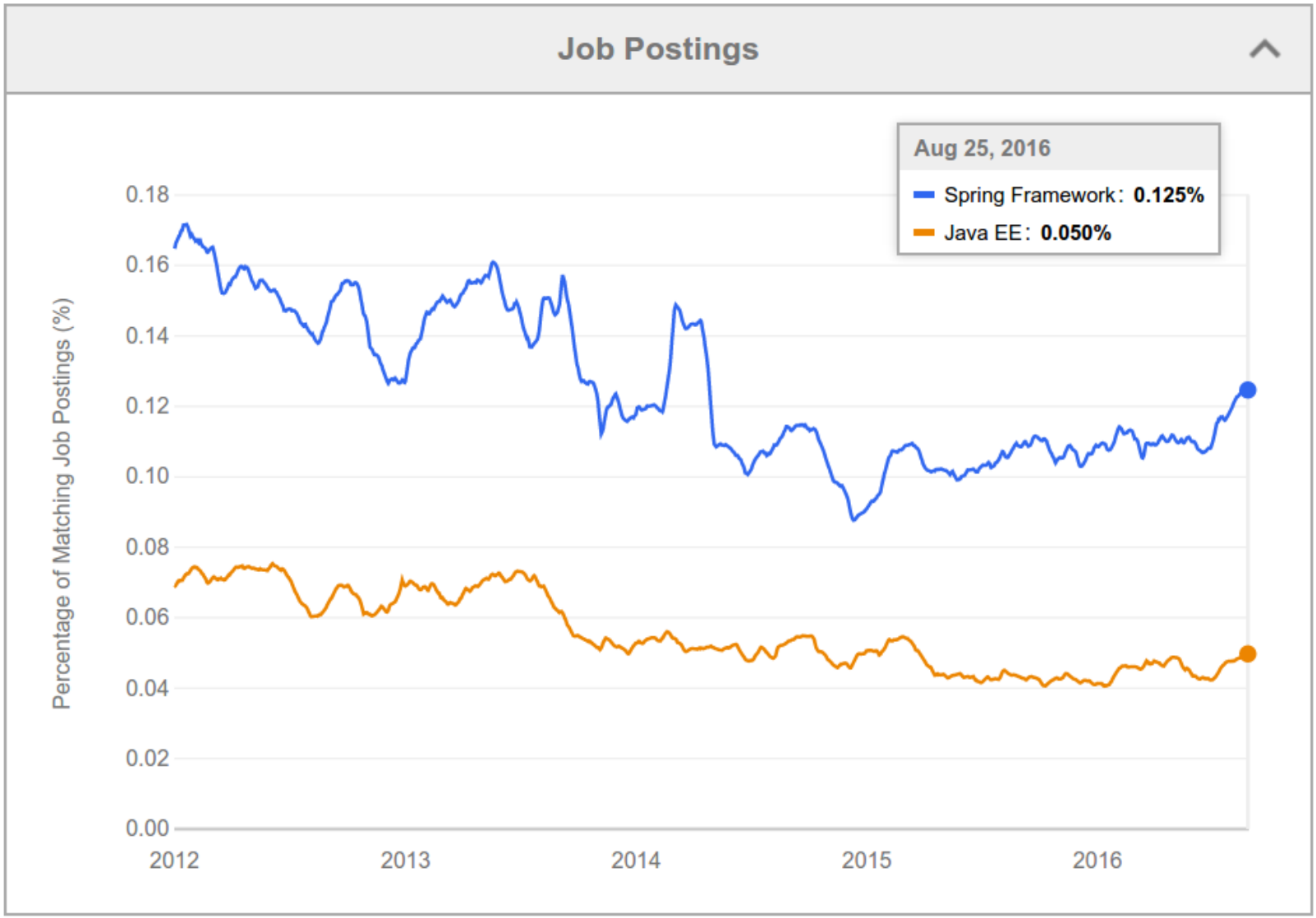
Contents

Business Logic

Spring and Java EE

Job Trends by `indeed.com`



Spring Framework Highlights

pros

- Dependency Injection
- Convention over Configuration
- Many Components for desktop/web/enterprise application development
  - Modular, i.e. individual Spring components can be used and combined with other frameworks
- Open-Source, POJO-Based

cons

- Not part of the Java EE stack

Examples

Examples from this lecture can be found at `https://gitlab.fel.cvut.cz/ear/spring-example`. Each commit contains an example, see commit logs.

Dependency Injection

Dependency Injection Motivation I

```
package cz.cvut.kbss.ear.spring_example;
import ...

public class SchoolInformationSystem {

  private CourseRepository repository
    = new InMemoryCourseRepository();

  public static void main(String[] args) {
    SchoolInformationSystem main = new SchoolInformationSystem();
    System.out.println(main.repository.getName());
  }
}
```

The client code (`SchoolInformationSystem`) itself decides which repository implementation to use

- change in **implementation** requires *client code* change.
- change in **configuration** requires *client code* change.

DI using XML

SchoolInformationSystem.java

```
package cz.cvut.kbss.ear.spring_example;
import ...

public class SchoolInformationSystem {
  private CourseRepository repository;

  public static void main(String[] args) {
    final String C
      = "classpath*:application-config.xml";
    final ApplicationContext ac
      = new ClassPathXmlApplicationContext(C);
    SchoolInformationSystem s = ac.getBean(
      SchoolInformationSystem.class
    );

    System.out.println(s.repository.getName());
  }
}
```

CourseRepository.java

```
package cz.cvut.kbss.ear.spring_example;
public interface CourseRepository {
  public String getName() { return name; }
}
```

InMemoryCourseRepository.java

```
package cz.cvut.kbss.ear.spring_example;
import ...

public class InMemoryCourseRepository
  implements CourseRepository {
  public String getName() { return
    "In-memory course repository"; }
}
```

application-config.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<beans ...>
  <bean
    id="SchoolInformationSystem"
    class="cz.cvut.kbss.ear.
      spring_example.SchoolInformationSystem"
    scope="singleton">
      <property name="repository"
        ref="CourseRepository"/>
  </bean>
  <bean id="CourseRepository"
    class="cz.cvut.kbss.ear.
      spring_example.InMemoryCourseRepository">
  </bean>
</beans>
```

Dependency Injection (DI) and Inversion of Control (IoC)

Dependency Injection

The application lifecycle is controlled by the *container* which is responsible for delivering correct implementation of the given bean

Inversion of Control

The programmed application is a "library" for the generic framework that controls the application lifecycle.

Hollywood Principle

Don't call us, we'll call you.

DI using Annotations

SchoolInformationSystem.java

```
package cz.cvut.kbss.ear.spring_example;
import ...

@Component
public class SchoolInformationSystem {
  @Autowired
  private CourseRepository repository;

  public static void main(String[] args) {
    final String C
      = "classpath*:application-config.xml";
    final ApplicationContext ac
      = new ClassPathXmlApplicationContext(C);
    SchoolInformationSystem s = ac.getBean(
      SchoolInformationSystem.class
    );

    System.out.println(s.repository.getName());
  }
}
```

CourseRepository.java

```
package cz.cvut.kbss.ear.spring_example;
public interface CourseRepository {
  public String getName() { return name; }
}
```

InMemoryCourseRepository.java

```
package cz.cvut.kbss.ear.spring_example;
import ...

@Component
public class InMemoryCourseRepository
  implements CourseRepository {
  public String getName() { return
    "In-memory course repository"; }
}
```

application-config.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<beans ... >
  <context:annotation-config/>
  <context:component-scan base-package
    ="cz.cvut.kbss.ear.spring_example"/>
</beans>
```

DI with JSR 330 annotations and bean disambiguation

JSR 330: Dependency Injection for Java

is a part of Java EE Web Profile. Spring supports JSR 330 annotations.

SchoolInformationSystem.java

```
package cz.cvut.kbss.ear.spring_example;
import ...

@Named
public class SchoolInformationSystem {
  @Inject
  private CourseRepository repository;

  ...
}
```

CourseRepository.java

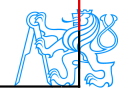
```
package cz.cvut.kbss.ear.spring_example;
public interface CourseRepository {
  public String getName() { return name; }
}
```

InMemoryCourseRepository.java

```
package cz.cvut.kbss.ear.spring_example;
import ...

@Named
public class InMemoryCourseRepository
  implements CourseRepository {
  public String getName() { return "In-memory
    course repository"; }
}
```

AnotherInMemoryCourseRepository.java

```
package cz.cvut.kbss.ear.spring_example;
import ...

@Named("repository")
public class AnotherInMemoryCourseRepository
  implements CourseRepository {
  public String getName() { return "Another
    In-memory course repository"; }
}
```



Related Dependency Technologies

Dependency Injection for Java (JSR 330)

- dependency mechanism
- (partially) implemented in Spring

$\in$ Java EE Web Profile

Context Dependency Injection (CDI) (JSR 299)

- definition of bean scopes
- not implemented in Spring

$\in$ Java EE Web Profile

Spring Bean Scopes

singleton	a single bean instance per Spring IoC container
prototype	a new bean instance each time when requested
request	a single bean instance per HTTP request
session	a single bean instance per HTTP session
globalSession	a single bean instance per global HTTP session

global HTTP session

A session shared accross multiple portlets in a portlet application.

Spring allows custom scope definition (e.g. JSF 2 Flash scope)

Spring Bean Scopes – Prototype

SchoolInformationSystem.java

```
package cz.cvut.kbss.ear.spring_example;
import ...

@Component
@Scope("singleton")
public class SchoolInformationSystem {
  @Autowired
  private CourseRepository repository;

  @Autowired
  private CourseRepository
    secondRepository;
  ...

  public static void main(String[] args) {
    ...
    // injected SchoolInformationSystem s;
    System.out.println(
      s.repository == s.secondRepository
    );
  }
}
```

prints “false”

CourseRepository.java

```
package cz.cvut.kbss.ear.spring_example;
public interface CourseRepository {
  public String getName() { return name; }
}
```

AnotherInMemoryCourseRepository.java

```
package cz.cvut.kbss.ear.spring_example;
import ...

@Component("repository")
@Scope("prototype")
public class AnotherInMemoryCourseRepository
  implements CourseRepository {
  public String getName() { return "Another
    In-memory course repository"; }
}
```

Spring Bean Scopes – Singleton

SchoolInformationSystem.java

```
package cz.cvut.kbss.ear.spring_example;
import ...

@Component
@Scope("singleton")
public class SchoolInformationSystem {
  @Autowired
  private CourseRepository repository;

  @Autowired
  private CourseRepository
    secondRepository;
  ...

  public static void main(String[] args) {
    ...
    // injected SchoolInformationSystem s;
    System.out.println(
      s.repository == s.secondRepository
    );
  }
}
```

prints “true”

CourseRepository.java

```
package cz.cvut.kbss.ear.spring_example;
public interface CourseRepository {
  public String getName() { return name; }
}
```

AnotherInMemoryCourseRepository.java

```
package cz.cvut.kbss.ear.spring_example;
import ...

@Component("repository")
@Scope("singleton")
public class AnotherInMemoryCourseRepository
  implements CourseRepository {
  public String getName() { return "Another
    In-memory course repository"; }
}
```

Dependency management for non-Spring objects

- sometimes Spring cannot manage bean lifecycle, but needs to inject into it
  - objects of other frameworks need not be ready for being managed by Spring
  - JPA entities – based on OO paradigm, objects should encapsulate both state and operations
- annotation `@Configurable` denotes classes, objects of which are not managed by Spring, yet can inject Spring-managed objects
  - byte-code instrumentation (aspect weaving)
    - Load-Time weaving (java agent)
    - Compile-time weaving (aspect compiler)

@Configurable – Example

```
@Configurable(preConstruction=true)
@Entity
public class User {

  @Column(length=40, nullable=false)
  private String password;

  @Column(length=40, nullable=false)
  private String salt;

  @Autowired
  private transient HashProvider provider;
  ...
  public void setPassword(String password) {
    this.password = provider.computeHash(
    password + salt + "/* long string */");
  }
}
```

Spring Container Features

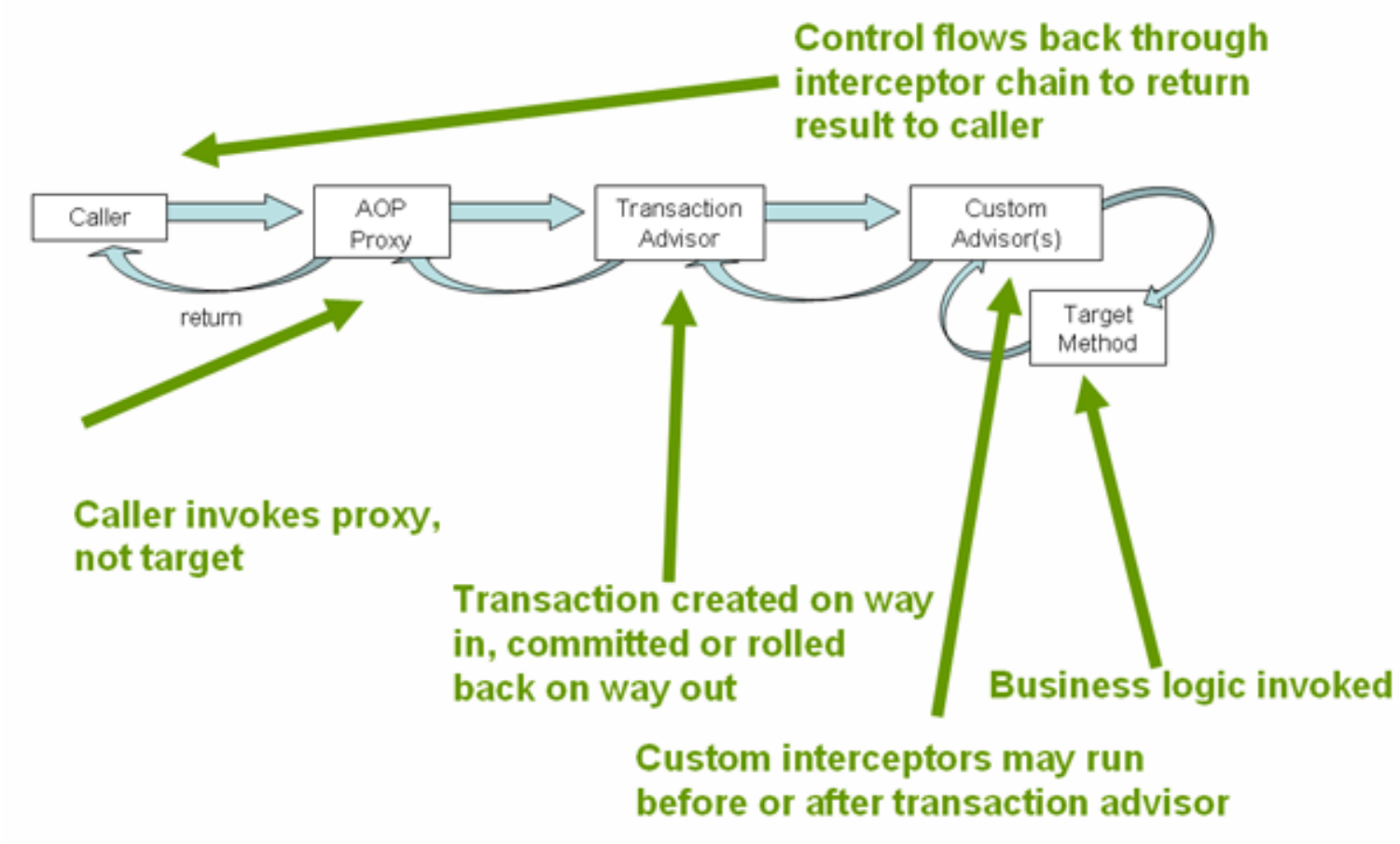
Transactions

```java
public interface UserService {

@Transactional(readOnly=true)
public List<UserDTO> getAllUsers();

@Transactional
public UserDTO saveUser(UserDTO user, String
password);

@Transactional(readOnly=true)
public UserDTO getUserByUserName(String name);

@Transactional
public void deleteUser(Long id);
...
}
```

```xml
<!-- from the file 'context.xml' -->
<?xml version="1.0" encoding="UTF-8"?>
<beans ...>
   <bean id="userService"
     class="....UserService"/>
   <tx:annotation-driven
  transaction-manager="txManager"/>
   <bean id="txManager"
     class="org.springframework.jdbc.
      datasource.DataSourceTransactionManager">
      <!-- (this dependency is defined
        somewhere else) -->
      <property name="dataSource"
        ref="dataSource"/>
   </bean>
</beans>
```

- transactions configurable through XML/annotations
- global/local transactions
- wraps multiple transaction APIs – JDBC, JTA, JPA, ...

Transaction Flow



source: Spring documentation,
`docs.spring.io/spring-framework/docs/4.2.x/spring-framework-reference/html/transaction.html`

Spring and Persistence

1. use standard JPA configuration through `persistence.xml` and load it by Spring
   - reuse of existing configuration
   - two XML configuration types
2. configure JPA using Spring
   - one type of XML configuration
   - one more dependency on Spring ...

JPA Configuration

```
<bean id="entityManagerFactory"
      class="org.springframework.orm.jpa.
             LocalContainerEntityManagerFactoryBean">
  <property name="dataSource" ref="dataSource"/>
  <property name="jpaVendorAdapter">
    <bean class="org.springframework.orm.jpa.vendor.
                 HibernateJpaVendorAdapter">
      <property name="databasePlatform"
        value="${jpa.platform}"/>
      <property name="generateDdl" value="true"/>
      <property name="showSql" value="true"/>
    </bean>
  </property>
  <property name="packagesToScan" value="cz.xy" />
</bean>
```

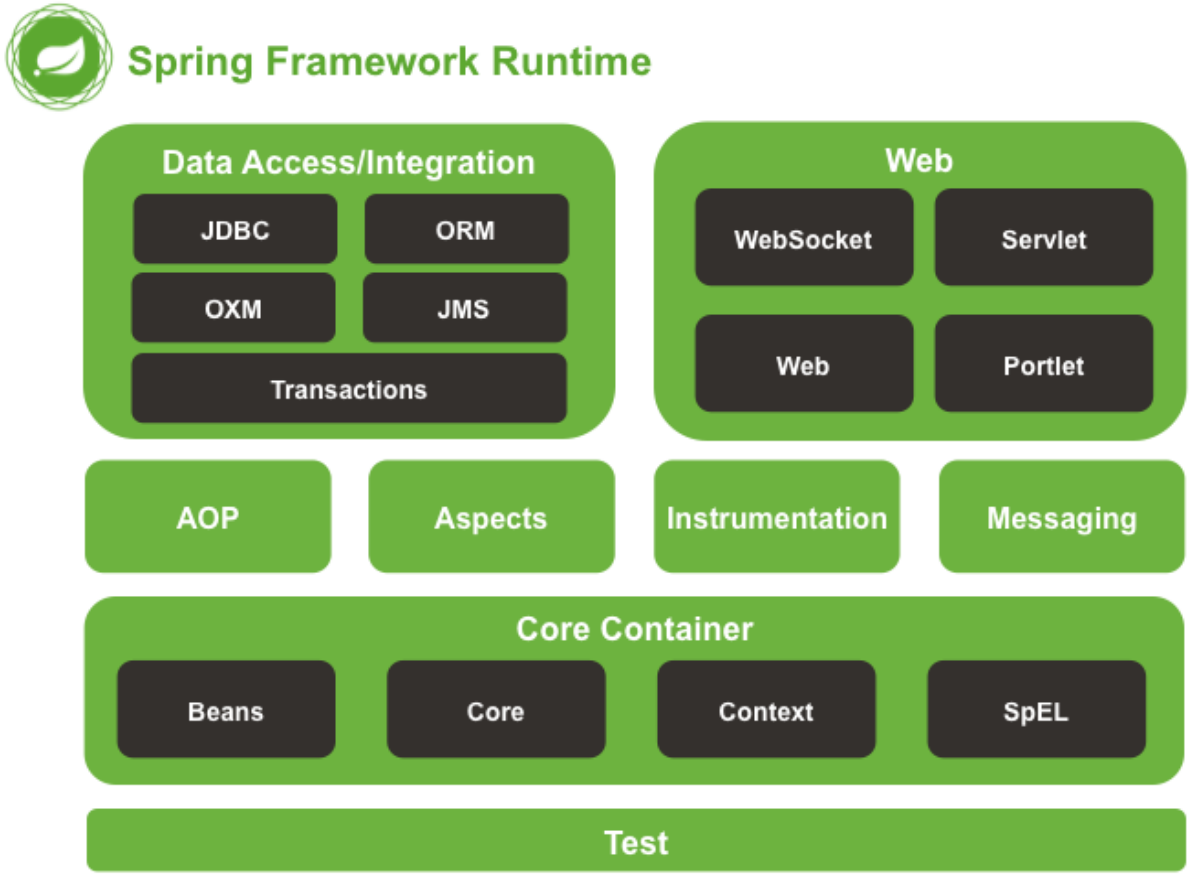
Security

```
@Transactional(propagation=Propagation.REQUIRED)
public interface UserService {

@Secured("ROLE_ADMIN")
public UserDTO save(UserDTO userDTO, String password,
                    Boolean isAdmin, Boolean isEditor);

@Secured("ROLE_ADMIN")
public void removeById(Long id);
...
}
```

- Method Access using Annotations

Spring Modules

Spring Landscape



source: Spring documentation,
`docs.spring.io/spring/docs/current/spring-framework-reference/html/overview.html`

Selected Spring Modules

Spring Core	framework core
Spring ORM	JPA integration and ORM
Spring MVC	MVC web framework
Spring Test	testing support
Spring Security	application security support
Spring Social	social setwork support
Spring Integration	System Integration (Enterprise Integration Patterns)

Spring 5 – Coming Soon

Spring 5 Features

- Java 8 adjustments
- `@Nullable` and `@NotNull` – compile time validation of null values
- Kotlin support – functional programming (web endpoints/bean registration).
- reactive programming – "async logic without callbacks"

Spring vs. EJB

Spring and EJB

- both technologies provide enterprise container with DI and transactions,
- EJB is a part of Java EE stack, it is a standard, supportin high-availability, clustering.
- Spring is a feature-rich alternative to EJB with many extensions cf. EJB, e.g. `@Configurable`
- A comparison is at `https://zeroturnaround.com/rebellabs/spring-and-java-ee-head-to-head`

Resources

- SpringSource
  `http://www.springsource.org`
- Spring Framework – Documentation
  `http://static.springsource.org/spring/docs/4.2.x/spring-framework-reference/html`
- Spring (WPA lecture)
  `https://cw.fel.cvut.cz/wiki/_media/courses/a7b39wpa/spring1.pdf`