Spring Core Introduction

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Introduction to Spring

- Open source application framework
- Modular (MVC, AOP, Integration, Security etc.)
- Extendible
- The most popular framework
- De facto standard

Core Container

The Core Container consists of the following modules:

- **spring-core** and **spring-beans**
  fundamental part: IoC, DI, BeanFactory
- **spring-context** (ApplicationContext)
  it is a medium to access any objects defined and configured
- **spring-context-support**
  provides support for integrating common third-party libraries
- **spring-expression (SpEL)**
  language to query/manipulate objects at runtime

Inversion of Control (IoC)

- Is an application development concept
- Hollywood Principle: *Don't call us, we'll call you*

> In software engineering, inversion of control (IoC) describes a design in which custom-written portions of a computer program receive the flow of control from a generic, reusable library.

Dependency Injection (DI)

Is a form of IoC

> An injection is the passing of a dependency (a service) to a dependent object (a client). Passing the service to the client, rather than allowing a client to build or find the service, is the fundamental requirement of the pattern.

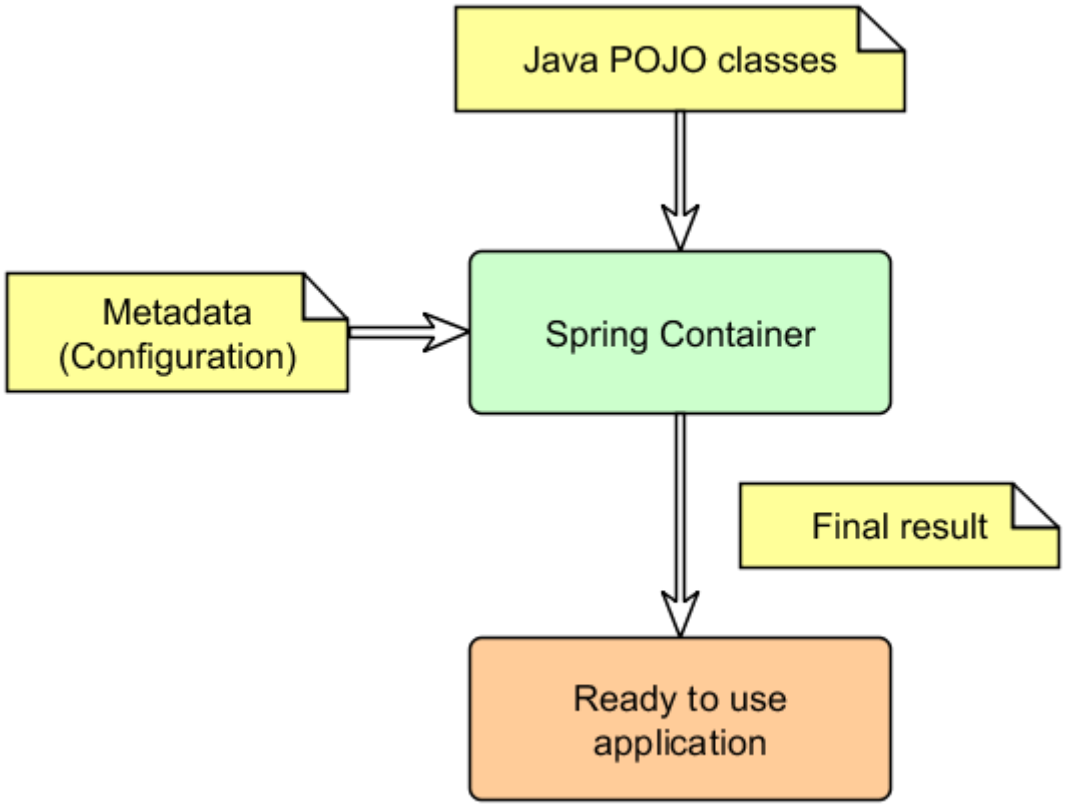
Two major variants: constructor and setter injection

Benefits of IoC/DI

- Minimizes the amount of code
- Makes the application more testable
- Promotes programming to interfaces
- Loose coupling with minimal effort
- Supports eager instantiation and lazy loading
- Provides control over object lifecycle

Spring IoC container

Create objects, wire them together, configure them, manage their lifecycle from creation to destruction.



Creating application context

Environments:

- Standalone

- WEB
- JUnit
- etc.

Special prefixes:

- ClassPath
- FileSystem
- RelativePath
- AnnotationConfig

Instantiate standalone context - example

```
// create and configure beans
ApplicationContext context =
    new ClassPathXmlApplicationContext(new String[] {"services.xml", "daos.xml"});

// retrieve configured instance
UserService service = context.getBean("userService", UserService.class);

// use configured instance
List<String> userList = service.getUsernameList();
```

Context Lifecycle

1. Load definitions
2. BeanFactoryPostProcessor
3. Instantiation
4. Property Injection
5. BeanPostProcessor
6. Ready to use

Bean Lifecycle

1. Instantiate
2. Populate Properties
3. BeanNameAware#setBeanName()
4. BeanFactoryAware#setBeanFactory()
5. ApplicationContextAware#setApplicationContext()
6. Preinitialization BeanPostProcessors
7. InitializingBean#afterPropertiesSet()
8. Call custom init-method
9. Postinitialization BeanPostProcessors
10. Bean is ready to use

Bean Lifecycle - destroy

When container is shut down

1. DisposableBean#destroy()
2. Call custom destroy-method

Bean scopes

- simple: singleton (default), prototype

```
<bean id="..." class="..." scope="prototype"> ... </bean>
```

- runtime: thread, custom (org.springframework.beans.factory.config.Scope)
- web-aware: request, session, global session, application

XML based Configuration

```
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://www.springframework.org/schema/beans
        http://www.springframework.org/schema/beans/spring-beans.xsd">

    <bean id="userService" class="com.acme.UserServiceImpl">
        <property name="userDao" ref="userDao"/>
    </bean>

    <bean id="userDao" class="com.acme.UserDaoImpl">
        <property name="driverClassName" value="${jdbc.driverClassName}" />
        <property name="url" value="${jdbc.url}" />
        <property name="username" value="${jdbc.username}" />
        <property name="password" value="${jdbc.password}" />
    </bean>
</beans>
```

Instantiating bean

A bean can be instantiated with:

1. Constructor
2. Static factory method
3. Instance factory method
4. FactoryBean

Instantiating bean - Constructor

```
<bean id="userService" class="com.acme.UserServiceImpl" />
```

```
public class UserServiceImpl implements UserService {

    public UserServiceImpl() { ... }
}
```

Instantiating bean - Static method

```
<bean id="userService" class="com.acme.UserServiceImpl"
    factory-method="createInstance" />
```

```
public class UserServiceImpl implements UserService {

    private UserServiceImpl() { ... }

    public static UserService createInstance() { ... }
}
```

Instantiating bean - Factory method

```
<bean id="userServiceFactory" class="com.acme.UserServiceFactoryImpl"/>
<bean id="userService" factory-bean="userServiceFactory"
    factory-method="createInstance" />
```

```
public class UserServiceFactory {

    public static UserService createInstance() { ... }
}
```

Instantiating bean - Factory bean

```
// org.springframework.beans.factory.FactoryBean
public interface FactoryBean<T> {
    T getObject() throws Exception;
    Class<?> getObjectType();
    boolean isSingleton();
}
```

```
public class UserServiceFactoryBean implements FactoryBean<UserService>{
    public UserService getObject() {
        // create user service
    }

    public Class<Car> getObjectType() { return UserService.class; }

    public boolean isSingleton() { return false; }
}
```

```
<bean id="userService" class="com.acme.UserServiceFactoryBean"/>
```

Dependency Injection variants

Major variants:

- Constructor-based
- Setter-based

Constructor-based DI

Good practice to use constructor based DI for mandatory dependencies. Supports immutability.

```
<bean id="userService" class="com.acme.UserServiceImpl">
    <constuctor-arg ref="userDao"/>
</bean>
```

```
public class UserServiceImpl implements UserService {
    private final UserDao userDao;

    public UserService(UserDao userDao) {
        this.userDao = userDao;
    }
}
```

Setter-based DI

For optional dependencies and default values.

```
<bean id="userService" class="com.acme.UserServiceImpl">
    <property name="userDao" ref="userDao"/>
</bean>
```

```
public class UserServiceImpl implements UserService {
    private UserDao userDao;

    public setUserDao(UserDao userDao) {
        this.userDao = userDao;
    }
}
```

Additional features

- bean definition inheritance

```
<bean id="parent" abstract="true"> ... </bean>
<bean id="service" parent="parent" class="com.acme.ServiceImpl"> ... </bean>
```

- Importing configuration files

```
<import resouce="classpath:service-config.xml"/>
```

- Lazy initialization

```
<bean id="service" class="com.acme.Service" lazy-init="true"> ... </bean>
```

- Force dependency initialization beforehand

```
<bean id="service" class="com.acme.Service" depends-on="dao"> ... </bean>
```

- Autowiring

Annotation Based Configuration

- An alternative to XML setup
- Annotation injections are performed before XML

Basic configuration

```xml
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:context="http://www.springframework.org/schema/context"
    xsi:schemaLocation="http://www.springframework.org/schema/beans
        http://www.springframework.org/schema/beans/spring-beans.xsd
        http://www.springframework.org/schema/context
        http://www.springframework.org/schema/context/spring-context.xsd">

    <!-- looks for annotations on beans -->
    <context:annotation-config/>

    <!-- scan classes and registers bean definitions -->
    <context:component-scan base-package="com.acme" />

</beans>
```

Basic annotations

Spring	JSR 250	JSR 330
@Autowired	@Resource	@Inject
@Qualifier		@Named
@Component		@Named
@Scope		@Scope, @Singleton
@Required		
@Value		
@Lazy		
@DependsOn		
	@PostConstruct	
	@PreDestory	

@Autowired

```java
@Component
public class UserServiceImpl implements UserService {

    @Autowired
    @Qualifier("userDao")
    private UserDao userDao;

    // ...
}
```

@Resource

```
@Component
public class UserServiceImpl implements UserService {

    @Resource(name = "userDao")
    private UserDao userDao;

    // ...
}
```

@Autowired vs. @Resource

@Autowired and @Inject

- Matches by Type
- Restricts by Qualifiers
- Matches by Name

@Resource

- Matches by Name
- Matches by Type
- Restricts by Qualifiers (ignored if match is found by name)

More information in article: blogs.sourceallies.com/2011/08/spring-injection-with-resource-and-autowired/

@Value

```
public class CurrencyService {

    @Value("${default.currency.code}")
    private String defaultCurrencyCode;

    // ...
}
```

Basic annotations - continued

Context:

- @Scope
- @Bean
- @DependsOn

- @Lazy

Transactional:

- @Transactional

Java based configuration

```
// simple
new AnnotationConfigApplicationContext(ApplicationConfig.class);
```

```
// programmatically
context = new AnnotationConfigApplicationContext();
context.register(ApplicationConfig.class);
context.refresh();
```

```
// scanning
context = new AnnotationConfigApplicationContext();
context.scan("com.acme");
context.refresh();
```

Approach to configurations

- XML: infrastructure beans
- Annotations: working beans, e.g. controllers

Links

- http://spring.io/
- Reference Documentation

Spring DI Alternatives

- Google Guice - a lightweight dependency injection framework
- Dagger - a fast dependency injector for Android and Java
- PicoContainer

Thank you!