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# Java Technology

1

## SPRING FRAMEWORK CORE

# Agenda – what to do in this Spring



- Dependency Injection
- Overview of Spring Framework
- Various injections and their usages in detail
- Bean scope
- Bean wiring
- Inner bean
- Bean properties
- Bean life cycle
- Bean auto wiring
- Spring Annotation

# High Dependency = High Responsibility



```
public class Tiger {
   public void eat() {
      System.out.println("Do not disturb");
   }
}
```

```
public class MainClass {
   public static void main(String… args) {
      Tiger t = new Tiger();
      t.eat();
   }
}
```

- **Requirement:** Change Tiger to Lion.
- **Me:** Urgggghhh. Too many changes.
  1. Standalone Lion class
  2. Change the object declaration to Lion
  3. Change the reference
  4. Compile again
  5. Test

# A bit less dependency



```
public interface Animal {
  void eat();
}
```

```
public class Tiger implements Animal {
  @Override
  public void eat() {
    System.out.println("Do not disturb");
  }
}
```

```
public class MainClass {
  public static void main(String… args) {
    Animal a = new Tiger();
    a.eat();
  }
}
```

- **Requirement:** Change Tiger to Lion.
- **Me:** Ufff. Again some changes.
  1. Lion implements Animal
  2. Change the object declaration to Lion
  3. ~~Change the reference~~
  4. Compile again
  5. Test

# Dependency Injection



```
public interface Animal {
 void eat();
}
```

```
public class Tiger implements Animal {
 @Override
 public void eat() {
  System.out.println("Do not disturb");
 }
}
```

```
public class MainClass {
 public static void main(String… args) {
  ApplicationContext aC = new ClassPathXmlApplicationContext("wildLife.xml");
  Animal a = (Animal) aC.getBean("animal");
  a.eat();
 }
}
```

- **Requirement:** Change Tiger to Lion.
- **Me:** Ok. Small change.
  1. Lion implements Animal
  2. Change bean class to Lion
  3. ~~Change the reference~~
  4. ~~Compile again~~
  5. Test

**wildLife.xml**

```
<bean id = "animal" class = "Tiger" />
```

# So what is Spring?



- IoC container
- Lightweight framework
- Fully modularized (High decoupling)
- Considered an alternative / replacement for the Enterprise JavaBean (EJB) model
- Flexible
  - Programmers decide how to program
- Not exclusive to Java (e.g. .NET)
- Solutions to typical coding busywork
  - JDBC
  - LDAP
  - Web Services

# What Spring offers?



- Dependency Injection (DI)
  - DI is implemented through IoC (Inversion of Control)
- Aspect Oriented Programming
  - Runtime injection-based
- Portable Service Abstractions
  - The rest of spring
    - ORM, DAO, Web MVC, Web, etc.
    - Allows access to these without knowing how they actually work
- Easily testable

# What is a bean?



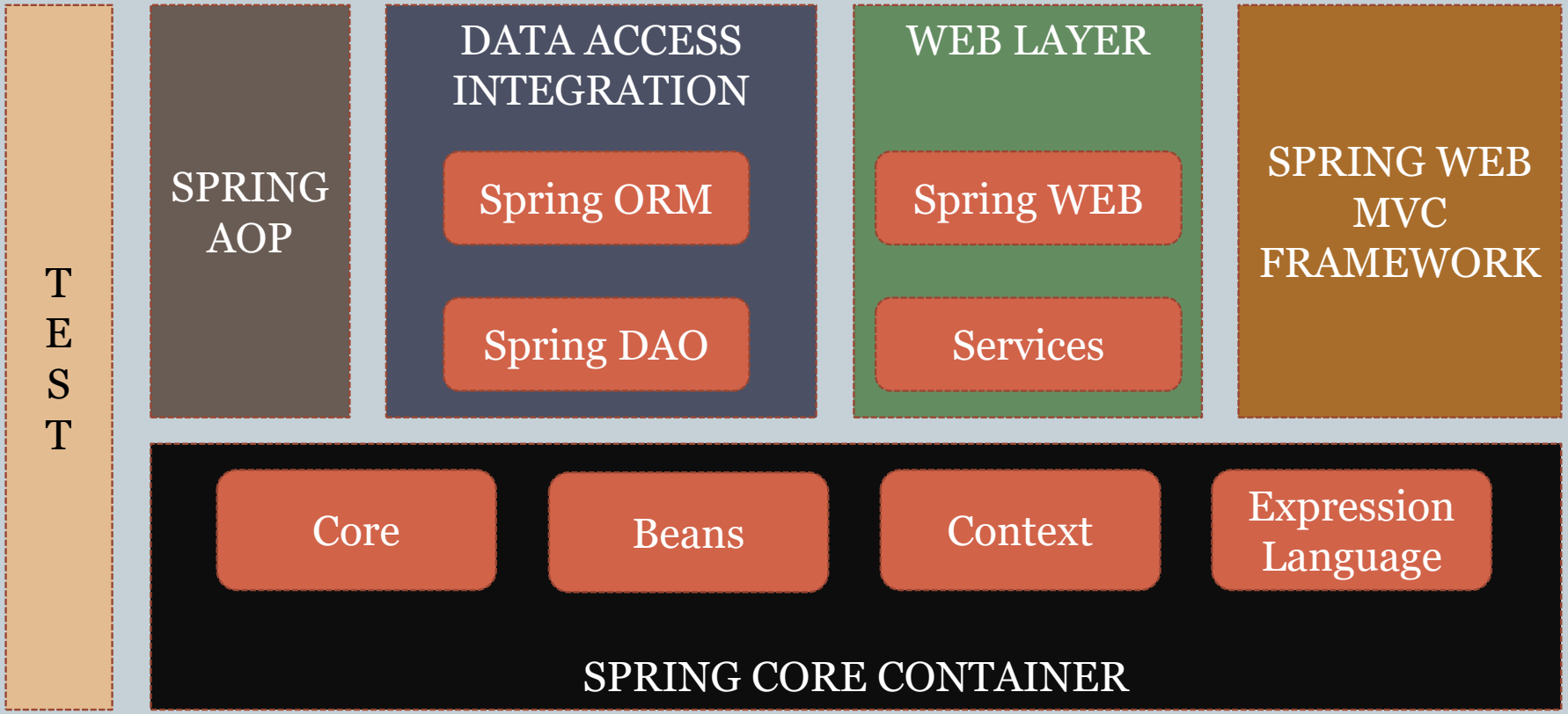
- A Bean is a class that has only state but no behavior
- A Bean must contain a no-argument constructor
- A Bean should be serialized

**Class**

**Bean**

# Spring Framework Architecture





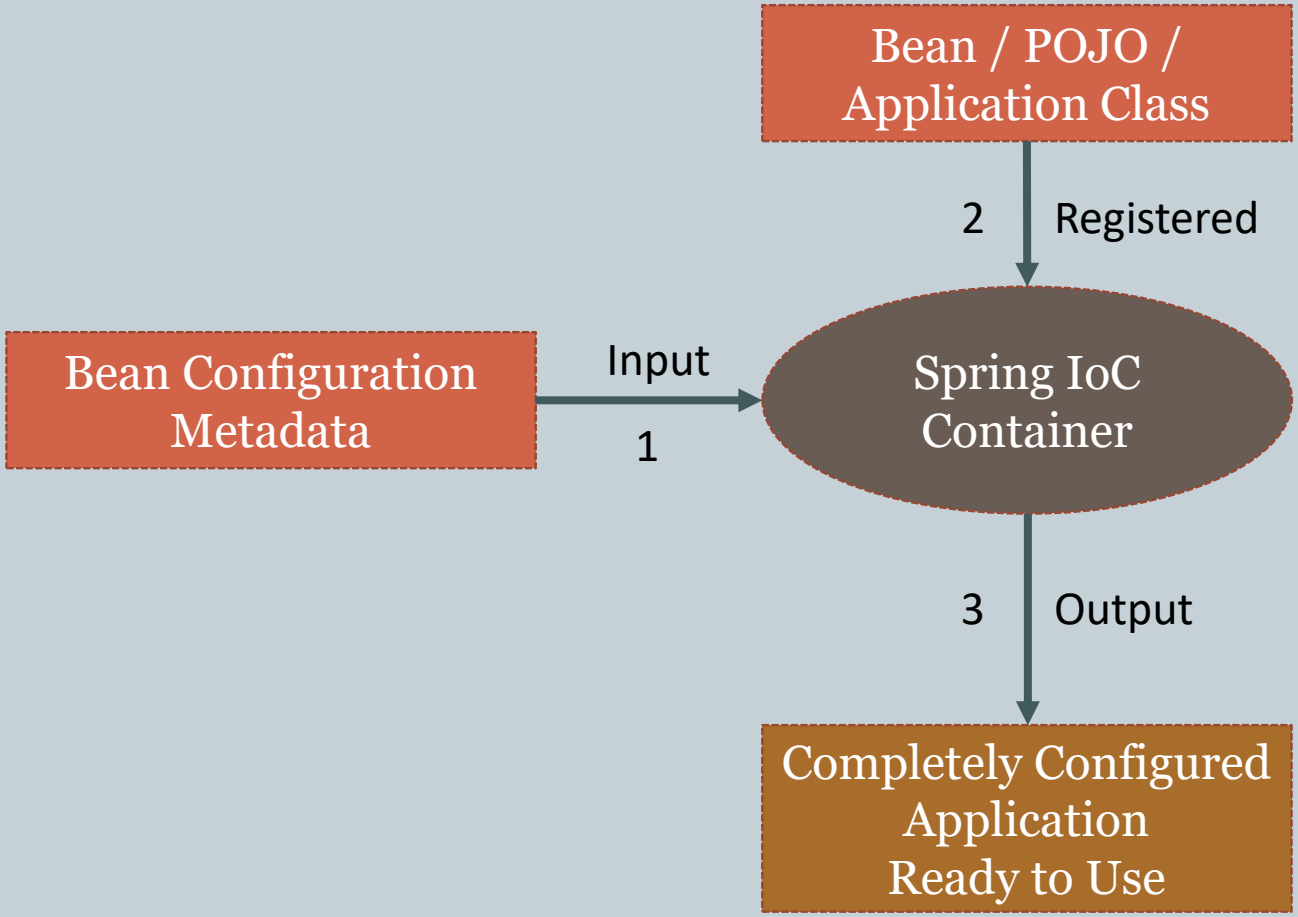
# Spring Bean Configuration



```
<?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-3.0.xsd
    http://www.springframework.org/schema/context
    http://www.springframework.org/schema/context/spring-context-3.0.xsd" >

   <bean id = "animal" class = "com.pushan.spring.beans.Tiger" >
       <property name = "msg" value = "Eating now" />
   </bean>

   <!--
       .
       .
       .
   -->
</beans>
```

# Spring IoC Container





# Spring IoC Container contd…



| BeanFactory | ApplicationContext |
|---|---|
| The simplest factory, mainly for DI | The advanced and more complex factory |
| Used when resources are limited, e.g., mobile, applets etc. | Used elsewhere and has the below features,<br>1> Enterprise aware functions<br>2> Publish application events to listeners<br>3> Wire and dispose beans on request |
| org.springframework.beans.factory.BeanFactory | org.springframework.context.ApplicationContext |
| `XmlBeanFactory factory = new XmlBeanFactory (new ClassPathResource("wildLife.xml"));` | `ApplicationContext aC = new ClassPathXmlApplicationContext("wildLife.xml");` |

# Injection Methods

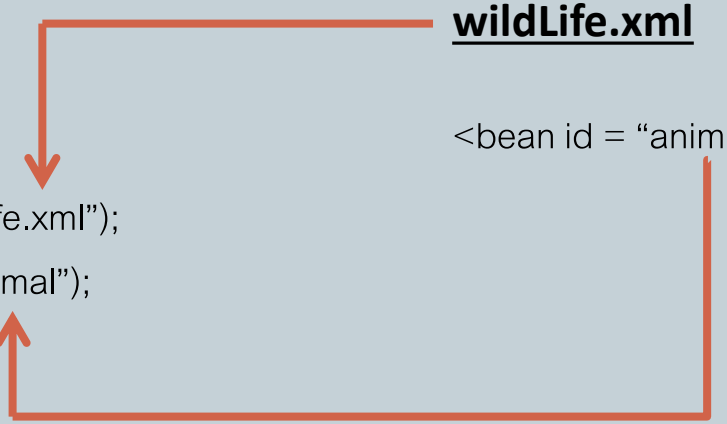


- Setter Injection
  - Pass dependencies in via property setters (e.g., Spring)
- Constructor Injection
  - Pass dependencies in via constructor (e.g., Spring)
- Interface Injection
  - Pass dependencies in via interfaces (e.g., Avalon)

```
public class MainClass {
   public static void main(String… args) {
      ApplicationContext aC = new
ClassPathXmlApplicationContext("wildLife.xml");
      Animal a = (Animal) aC.getBean("animal");
      a.eat();
   }
}
```

**wildLife.xml**

```
<bean id = "animal" class = "Tiger" />
```



# Setter Injection



- In the <bean>, Specify <property> tag.

```
public class College {
 private String collegeId;
 private int totalStudents;

 public String getCollegeId() {
  return collegeId;
 }
 public void setCollegeId(String collegeId) {
  this.collegeId = collegeId;
 }
 public int getTotalStudents() {
  return totalStudents;
 }
 public void setTotalStudents(int totalStudents) {
  this.totalStudents = totalStudents;
 }
}
```

```
public class MyClass {
 private static final String MY_COLLEGE = "myCollege";

 public static void main(String... args) {
  ApplicationContext ctx = new ClassPathXmlApplicationContext("springConfig.xml");

  College col = (College) ctx.getBean(MY_COLLEGE);

  System.out.println("College Id: " + col.getCollegeId());
  System.out.println("Total Students: " + col.getTotalStudents());
 }
}
```

```
<bean id="myCollege" class="com.pushan.study.spring.beans.College">
        <property name="collegeId" value="123Abc"/>
        <property name="totalStudents" value="500"/>
 </bean>
```

# Constructor Injection



- In the <bean>, Specify <constructor-arg>

```
public class College {

 private String collegeId;
 private int totalStudents;

 public void College (int tS, String cl) {
  this.totalStudents = tS;
  this.collegeId = cl;
 }

 public String getCollegeId(){
  return collegeId;
  }
  public int getTotalStudents() {
   return totalStudents;
  }
}
```

```
public class MyClass {
 private static final String MY_COLLEGE = "myCollege";

 public static void main(String... args) {
  ApplicationContext ctx = new ClassPathXmlApplicationContext("springConfig.xml");

  College col = (College) ctx.getBean(MY_COLLEGE);

  System.out.println("College Id: " + col.getCollegeId());
  System.out.println("Total Students: " + col.getTotalStudents());
 }
}
```

```
<bean id="myCollege" class="com.pushan.study.spring.beans.College">
        <constructor-arg type="int" value="500"/>
        <constructor-arg type="java.lang.String" value="123Abc"/>
 </bean>
```

# Constructor Injection Illustrated



- The ‘value’ attribute is mandatory and rest are optional, e.g., ‘type’
- Constructor Injection can automatically cast the value to the desired ‘known’ type
- By default the ‘type’ of the ‘value’ is ‘java.lang.String’ (if not specified explicitly)
- Constructor injection does not interpret ordering of the arguments specified

# Constructor Injection Ambiguity 1



```
<bean id="myCollege" class="com.pushan.College">
 <constructor-arg value="500"/>
 <constructor-arg value="123Abc"/>
</bean>
```

```
public class College {
 private String collegeId;
 private int totalStudents;
 private String collegeAdd;

 public College (int totalStudents, String collegeId){
  this.totalStudents = totalStudents;
  this.collegeId = collegeId;
 }

 public College (String collegeAdd, String collegeId){
  this.collegeAdd = collegeAdd;
  this.collegeId = collegeId;
 }
}
```

Which constructor will be called?

# Constructor Injection Ambiguity 1 Solution



```
<bean id="myCollege" class="com.pushan.College">
 <constructor-arg value="500" type="int"/>
 <constructor-arg value="123Abc" type="java.lang.String"/>
</bean>
```

```
public class College {
 private String collegeId;
 private int totalStudents;
 private String collegeAdd;

 public College (int totalStudents, String collegeId){
  this.totalStudents = totalStudents;
  this.collegeId = collegeId;
 }

 public College (String collegeAdd, String collegeId){
  this.collegeAdd = collegeAdd;
  this.collegeId = collegeId;
 }
}
```

The '**type**' of the value is specified

# Constructor Injection Ambiguity 2



```
<bean id="myCollege" class="com.pushan.College">
 <constructor-arg value="500" type="int"/>
 <constructor-arg value="123Abc" type="java.lang.String"/>
</bean>
```

```
public class College {
 private String collegeId;
 private int totalStudents;
 private String collegeAdd;

 public College (int totalStudents, String collegeId){
  this.totalStudents = totalStudents;
  this.collegeId = collegeId;
 }

 public College (String collegeAdd, int totalStudents){
  this.totalStudents = totalStudents;
  this. collegeAdd = collegeAdd;
 }
}
```

Which constructor will be called?

# Constructor Injection Ambiguity 2 Solution



```
<bean id="myCollege" class="com.pushan.College">
 <constructor-arg value="500" type="int" index="0"/>
 <constructor-arg value="123Abc" type="java.lang.String" index="1"/>
</bean>
```

```
public class College {
 private String collegeId;
 private int totalStudents;
 private String collegeAdd;

 public College (int totalStudents, String collegeId){
  this.totalStudents = totalStudents;
  this.collegeId = collegeId;
 }

 public College (String collegeAdd, int totalStudents){
  this.totalStudents = totalStudents;
  this. collegeAdd = collegeAdd;
 }
}
```

The '**index**' of the value is specified

# Bean Scope 1 – Object Type (Part I)



| Bean Scope | Description |
|---|---|
| singleton | Single instance of bean in every getBean() call [Default] |
| prototype | New instance of bean in every getBean() call |
| request | Single instance of bean per HTTP request |
| session | Single instance of bean per HTTP session |
| global-session | Single instance of bean per global HTTP session |
| thread | Single instance of bean per thread |
| custom | Customized scope |

We will look into 'singleton' and 'prototype' scopes only

Added in Spring 3.0

Valid in the context of web-aware ApplicationContext

# Bean Scope 1 – Object Type (Part II)



- Mainly bean can be of two types, viz.,
  1. **Singleton** (e.g., <bean scope="singleton" ... />)
  2. **Prototype** (e.g., <bean scope="prototype" ... />)
- A 'singleton' bean is created once in the Spring container. This 'singleton' bean is given every time when referred. It is garbage collected when the container shuts down.
- A 'prototype' bean means a new object in every request. It is garbage collected in the normal way, i.e., when there is no reference for this object.
- By default every bean is singleton if not specified explicitly.

# Bean Scope 2 - Inheritance

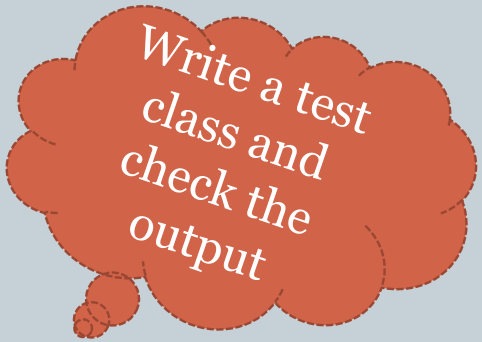


```
<bean id="a" abstract="true">
  <property name="msg1" value="Tiger runs" />
  <property name="msg2" value="Tiger eats" />
</bean>
```

```
<bean id="b" class="B" parent="a">
  <property name="msg1" value="Lion runs" />
  <property name="msg3" value="Lion sleeps" />
</bean>
```

```
public class A {
  private String msg1;
  private String msg2;

  //  getters and setters ...
}
```

```
public class B {
  private String msg1;
  private String msg2;
  private String msg3;

  //  getters and setters ...
}
```



# Bean Reference (wiring)



- Through setter or constructor injection we can refer to another bean which has its own separate definition.

```
public class Person{
 //   ...
}
```

```
<bean id="person"
class="Person" />
```

```
public class Location{
 private String city;

 public Location (String c)
  this.city = c;
 }

 //   ...
}
```

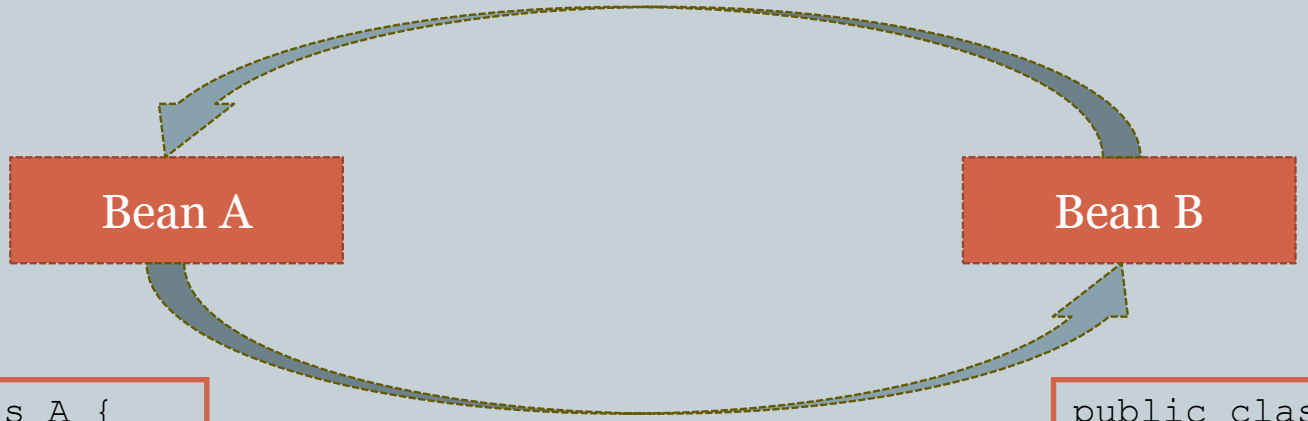
```
<bean id="location"
class="Location">
  <constructor-arg
value="Kolkata"
type="java.lang.String" />
</bean>
```

```
public class A {
 private String msg;
 private Person owner;
 private Location address;

 //   getters and setters ...
}
```

```
<bean id="a" class="A">
 <property name="msg" value="hello"/>
 <property name="owner" ref="person"/>
 <property name="address">
  <ref bean="location" />
 </property>
</bean>
```

# Circular Dependency






```
public class A {
   private B b;
   public A (B b) {
      this.b = b;
   }
}
```

```
public class B {
   private A a;
   public B (A a) {
      this.a = a;
   }
}
```

```
<bean id="a" class="A">
   <constructor-arg ref="b" />
</bean>

<bean id="b" class="B">
   <constructor-arg ref="a" />
</bean>
```

# Inner Bean



- Inner bean is also a bean reference.
- A bean defined within another bean.
- The inner bean is fully local to the outer bean.
- The inner bean has *prototype* scope.

```
<bean id="a" class="A">
 <property name="address">
  <bean class="Location">
   <property name="city" value="Kolkata"/>
   <property name="zip" value="700006"/>
  </bean>
 </property>
</bean>
```

```
public class A {
 private Location address;

 // getters and setters …
}

public class Location {
 private String city, zip;

 // getters and setters …
}
```

# Injecting Collection



| Tag Name | Inner Tag Name | Java Collection Type | Specification |
|---|---|---|---|
| <list> | <value> | java.util.List<E> | Allows duplicate entries |
| <map> | <entry> | java.util.Map<K, V> | Key-Value pair of any object type |
| <set> | <value> | java.util.Set<E> | Does not allow duplicate entries |
| <props> | <prop> | java.util.Properties | Key-Value pair of type 'String' |

# So, lets inject some collection then …



```
<bean id="animalCollection" class="AnimalCollection">
  <property name="animalList">
    <list>
      <value>Tiger</value>
      <value>Lion</value>
      <value>Tiger</value>
    </list>
  </property>
  <property name="animalSet">
    <set>
      <value>Lion</value>
      <value>Tiger</value>
      <value>Lion</value>
    </set>
  </property>
  <property name="animalMap">
    <map>
      <entry key="1" value="Tiger"/>
      <entry key="2" value="Lion"/>
      <entry key="3" value="Tiger"/>
    </map>
  </property>
  <property name="animalProp">
    <props>
      <prop key="one">Lion</prop>
      <prop key="two">Tiger</prop>
      <prop key="three">Lion</prop>
    </props>
  </property>
</bean>
```

Bean definition for DI

```
public class AnimalCollection {
  List<String> animalList;
  Set<String> animalSet;
  Map<String, String> animalMap;
  Properties animalProp;

  //  getters and setters ...
}
```

Bean

```
public class MainClass {
  public static void main(String… args) {
    ApplicationContext ctx = new
ClassPathXmlApplicationContext("wildLife.xml");

    AnimalCollection aC =(AnimalCollection)
ctx.getBean("animalCollection");

    System.out.println("animalList :" + aC.getAnimalList());
    System.out.println("animalSet:" + aC.getAnimalSet());
    System.out.println("animalMap:" + aC.getAnimalMap());
    System.out.println("animalProp:" + aC.getAnimalProp());
  }
}
```

Test class

```
animalList :[Tiger, Lion, Tiger]
animalSet :[Lion, Tiger]
animalMap :{1=Tiger, 2=Lion, 3=Tiger}
animalProp :{one=Lion, two=Tiger, three=Lion}
```

Output

# Constructor v/s Setter Injection



- Setter injection gets preference over constructor injection when both are specified
- Constructor injection cannot partially initialize values
- *Circular dependency can be achieved by setter injection*

- Security is lesser in setter injection as it can be overridden
- Constructor injection fully ensures dependency injection but setter injection does not
- Setter injection is more readable

# Bean Properties



| Tag Name | Description | Example |
|---|---|---|
| id | Unique Id | <bean id="person" ... /> |
| name | Unique Name | <bean name="lion" ... /> |
| class | Fully qualified Java class name | <bean class="a.b.C" ... /> |
| scope | Bean object type | <bean scope="singleton" ... /> |
| constructor-arg | Constructor injection | <constructor-arg value="a" /> |
| property | Setter injection | <property name="a" ... /> |
| autowire | Automatic Bean referencing | <bean autowire="byName" ... /> |
| lazy-init | Create a bean lazily (at its first request) | <bean lazy-init="true" ... /> |
| init-method | A callback method just after bean creation | <bean init-method="log" ... /> |
| destroy-method | A callback just before bean destruction | <bean destroy-method="log" ... /> |

# Bean Life Cycle Callbacks



*org.springframework.beans.factory.InitializingBean*

void afterPropertiesSet () throws Exception;

```
public class MyBean implements
InitializingBean {
  public void afterPropertiesSet () {
    //   Initialization work
  }
}
```

```
<bean id=“myBean"
      class=“MyBean" init-method="init"/>
```

```
public class MyBean {
  public void init () {
    //   Initialization work
  }
}
```

*org.springframework.beans.factory.DisposableBean*

void destroy () throws Exception;

```
public class MyBean implements
DisposableBean {
  public void destroy () {
    //   Destruction work
  }
}
```

```
<bean id=“myBean"
      class=“MyBean" destroy-method=“des"/>
```

```
public class MyBean {
  public void des () {
    //   Destruction work
  }
}
```

# Beans Auto-Wiring



- Spring container can auto wire beans
- In this case, there is no need to specify <property/> and/or <constructor-arg/> tags
- It decreases the amount of xml configuration

Removed in Spring 3.0

| Mode | Description | Example |
|---|---|---|
| no | No auto wiring of beans | Default |
| byName | Auto wire beans by property name | <bean autowire="byName" ... /> |
| byType | Auto wire beans by property type | <bean autowire="byType" ... /> |
| constructor | Auto wire beans by constructor | <bean autowire="constructor" ... /> |
| ~~autodetect~~ | ~~First try by constructor, then by type~~ | ~~<bean autowire="autodetect" ... />~~ |

# Auto wire by Name



```
public class Person {
  //   ...
}
```

```
<bean id="person"
class="Person" />
```

```
public class Location {
  private String city;

  public Location (String city) {
    this.city = city;
  }

  //   ...
}
```

```
<bean id="location"
class="Location">
  <constructor-arg value="Kolkata"
type="java.lang.String" />
</bean>
```

```
public class A {
  private String msg;
  private Person person;
  private Location location;

  //   getters and setters ...
}
```

```
<bean id="a" class="A“ autowire=“byName”>
  <property name="msg" value="hello" />
</bean>
```

# Auto wire by Type



```
public class Person {
  //   ...
}
```

```
<bean id="person"
class="Person" />
```

```
public class Location {
  private String city;

  public Location (String city) {
    this.city = city;
  }

  //   ...
}
```

```
<bean id="location"
class="Location">
  <constructor-arg value="Kolkata"
type="java.lang.String" />
</bean>
```

```
public class A {
  private String msg;
  private Person owner;
  private Location address;

  //   getters and setters ...
}
```

```
<bean id="a" class="A“ autowire=“byType”>
  <property name="msg" value="hello" />
</bean>
```

**<!-- The below bean definition will destroy the uniqueness of beans byType, hence Spring will give exception. -->**

```
<bean id=“person2" class=“Person”/>
```

# Auto wire by Constructor



```
public class Person {
  //   ...
}
```

```
<bean id="person"
class="Person" />
```

```
public class Location {
  private String city;

  public Location (String city) {
    this.city = city;
  }

  //   ...
}
```

```
<bean id="location"
class="Location">
  <constructor-arg value="Kolkata"
type="java.lang.String" />
</bean>
```

```
public class A {
  private String msg;
  private Person owner;
  private Location address;

  public A (String m, Person o, Location a){
    …
  }
}
```

```
<bean id="a" class="A“ autowire=“constructor”>
  <property name="msg" value="hello" />
</bean>
```

# Spring Auto-wiring Bottleneck



- Spring auto wiring has certain disadvantages or limitations, given below.

| Disadvantage | Description |
|---|---|
| Overriding beans configuration | If the bean configuration is specified explicitly then it overrides the bean auto wiring configuration |
| Unable to wire primitive types | Auto wiring is applicable only for beans and not for simple properties like primitives, String etc. |
| Auto wiring has confusing nature | Explicit wiring or manual wiring of beans is easier to understand than auto wiring. It is preferred to use explicit wiring if possible. |
| Partial wiring is not possible | Auto wiring will always try to wire all the beans through setter or constructor. It cannot be used for partial wiring. |

# @Spring (annotation = start)



- Evolved in Spring 2.0 (@Required).
- Developed and became famous from Spring 2.5
- “Old wine in new bottle” - an alternative of the xml configuration for bean wiring
- Not enabled by default (need explicit enabling)
- XML overrides annotation for bean configuration
- Sometimes gets treated as an anti-pattern since change of annotation configuration needs compilation of code
- IDE support

# Enabling Spring Annotation



```
<?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-3.0.xsd
    http://www.springframework.org/schema/context
    http://www.springframework.org/schema/context/spring-context-3.0.xsd" >

   <context:annotation-config/>

   <!--
      <bean ... />
      <bean ... />
          .
          .
          .
      <bean ... />
   -->
</beans>
```

# @Required



- **Applicable to only setter methods.**

```
public class Boy {
 private String name;
 private int age;

 @Required
 public void setName(String name){
  this.name = name;
 }

 @Required
 public void setAge(int age){
  this.age = age;
 }

 //   getters ...
}
```

- **Values by name.**

```
<bean id="boy" class="Boy">
 <property name="name" value="Rony"/>
 <property name="age" value="10"/>
</bean>
```

- **Strict checking.**

```
<bean id="boy" class="Boy">
 <property name="name" value="Rony"/>
</bean>
```

```
Property 'age' is required for bean
'boy'
```

# @Autowired



- **Applicable to methods, fields and constructors**

```
public class Boy {
 private String name;
 private int age;

 //   getters and setters ...
}

public class College {
 private String collegeId;
 @Autowired
 private Boy student;

 public void setCollegeId(String cI){
  this.collegeId = cI;
 }

 //   getters ...
}
```

No setter needed for autowiring on field

- **Wiring by type.**

```
<bean id="boy" class="Boy">
 <property name="name" value="Rony"/>
 <property name="age" value="10"/>
</bean>
<bean id="college" class="College">
 <property name="collegeId" value="1A"/>
</bean>
```

- **'required' attribute**

```
public class College {
 private String collegeId;
 @Autowired(required=false)
 private Boy student;

 //   ...
}
```

'student' auto wiring becomes optional

# @Qualifier



- **Solution to @Autowired for type ambiguity**

```
public class Boy {
 private String name;
 private int age;

 //   getters and setters ...
}

public class College {
 private String collegeId;
 @Qualifier(value="tony")
 @Autowired
 private Boy student;

 public void setCollegeId(String cI){
  this.collegeId = cI;
 }

 //   getters ...
}
```

Qualifier value

```
<bean id="boy1" class="Boy">
 <qualifier value="rony"/>
 <property name="name" value="Rony"/>
 <property name="age" value="10"/>
</bean>

<bean id="college" class="College">
 <property name="collegeId" value="1A"/>
</bean>

<bean id="boy2" class="Boy">
 <qualifier value="tony"/>
 <property name="name" value="Tony"/>
 <property name="age" value="8"/>
</bean>
```

- **If <qualifier/> is not configured, then searches with bean id/name. But if specified, it will always search with qualifier only.**

# @Resource, @PostConstruct, @PreDestroy



- @PostConstruct is an alternative of the init-method.
- @PreDestroy is an alternative of the destroy-method.
- @Resource(name="<beanName>") is used for auto wiring by name.
- @Resource can be applied in field, argument and methods.
- If no 'name' attribute is specified in @Resource, then the name is derived from the field, setter method etc.

```
<bean id="boy1" class="Boy">
 <property name="name" value="Rony"/>
 <property name="age" value="10"/>
</bean>

<bean id="college" class="College">
 <property name="collegeId" value="1A"/>
</bean>

<bean id="boy2" class="Boy">
 <property name="name" value="Tony"/>
 <property name="age" value="8"/>
</bean>
```

```
public class College {
 private String collegeId;

 @Resource(name="boy1")
 private Boy student;

 //   getters and setters ...
}
```

# @Configuration & @Bean (Part I)



```
@Configuration
public class AnimalConfig{
 @Bean
 public Lion lion(){
  return new Lion();
 }

 @Bean
 public Tiger tiger(){
  Tiger t = new Tiger();
  t.doInit();
  return t;
 }
}
```

```
 <bean id="lion" class="Lion" />

<bean id="tiger" class="Tiger"
 init-method="doInit" />
```

```
public class MainTest{
 public static void main(String[] a){
  ApplicationContext aC = new
AnnotationConfigApplicationContext(An
imalConfig.class);

  Tiger t = aC.getBean(Tiger.class);
  Lion l = aC.getBean(Lion.class);

  //   ...
 }
}
```

# @Configuration & @Bean (Part II)



```
@Configuration
public class LionConfig{
 @Bean(destroyMethod="clear")
 public Lion lion(){
  return new Lion();
 }
}

@Configuration
public class TigerConfig{
 @Bean(initMethod="doInit")
 public Tiger tiger(){
  return new Tiger();
 }
}
```

```
<bean id="lion" class="Lion"
destroy-method="clear" />

<bean id="tiger" class="Tiger"
init-method="doInit" />
```

```
public class MainTest{
 public static void main(String[] a){
  ApplicationContext aC = new
AnnotationConfigApplicationContext();

  aC.register(LionConfig.class,
TigerConfig.class);
  aC.refresh();

  //   ...
 }
}
```

# @Configuration & @Bean (Part III)



```
@Configuration
public class TigerConfig{
 @Bean
 public Tiger tiger(){
  return new Tiger();
 }
}
```

```
@Configuration
@Import(TigerConfig.class)
public class LionConfig{
 @Bean
 public Lion lion(){
  return new Lion();
 }
}
```

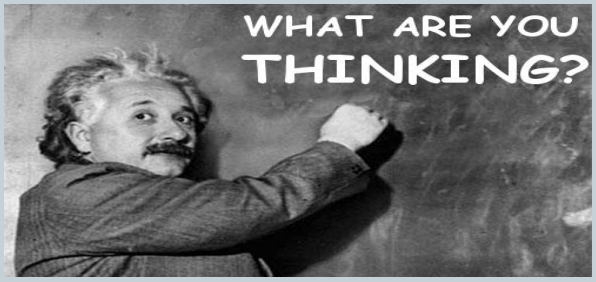
```
@Configuration
public class TigerConfig{
 @Bean(name="cat")
 @Scope("prototype")
 public Tiger tiger(){
  return new Tiger();
 }
}
```

```
<bean id="cat"
class="Tiger"
scope="prototype" />
```

# Try Yourself



- Are ‘Dependency Injection’ and ‘Inversion of Control’ same? Give reason for the answer.
- How to achieve circular dependency via both setter and constructor injection?
- How to declare the <property> of the bean together with the bean definition in a single line?
- Why does an inner bean have the default scope as ‘prototype’?




# Helping Resources



- Spring source documentation (http://www.springsource.org/documentation)
- Tutorials Point tutorial (http://www.tutorialspoint.com/spring)
- Mkyong tutorial (http://www.mkyong.com/tutorials/spring-tutorials)
- DZone (http://java.dzone.com/articles/case-spring-inner-beans)