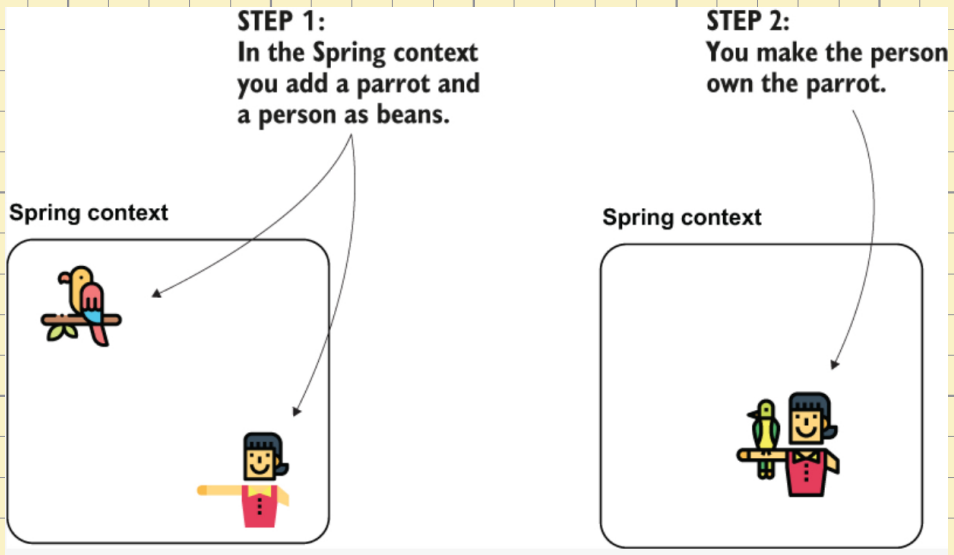
Wiring Beans

- 3 ways to wire beans
  - + Link the beans by directly calling the method that creates them (wiring) — @Bean in Config
  - + Enable Spring to provide us a value using a method parameter (auto-wiring) → framework controls the application at execution
  - + Dependency Injection (IoC principle - Inversion of Control) - @Autowired

Don't use @Bean in Config

1) The first 2 approaches
   - Register Beans to Spring context
   - → Establish a relationship



```
public class Parrot {

  private String name;

  // Omitted getters and setters

  @Override
  public String toString() {
    return "Parrot : " + name;
  }
}
```

add Beans to config

```
@Configuration
public class ProjectConfig {

  @Bean
  public Parrot parrot() {
    Parrot p = new Parrot();
    p.setName("Koko");
    return p;
  }

  @Bean
  public Person person() {
    Person p = new Person();
    p.setName("Ella");
    return p;
  }
}
```

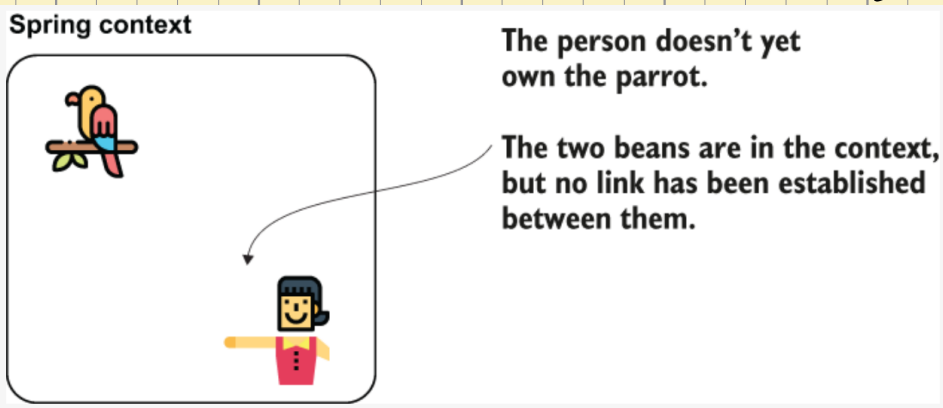
```
public class Person {

  private String name;
  private Parrot parrot;

  // Omitted getters and setters
}
```

```
public class Main {

  public static void main(String[] args) {
    var context = new AnnotationConfigApplicationContext
      (ProjectConfig.class);                          ❶

    Person person =
      context.getBean(Person.class);                  ❷

    Parrot parrot =
      context.getBean(Parrot.class);                  ❸

    System.out.println(
      "Person's name: " + person.getName());          ❹

    System.out.println(
      "Parrot's name: " + parrot.getName());          ❺

    System.out.println(
      "Person's parrot: " + person.getParrot());      ❻
  }}
```

❹ → Work

❺ → Work

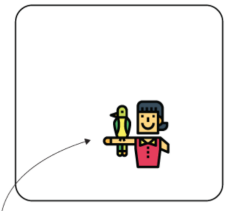
❻ → will not work cuz we haven't built the relationship



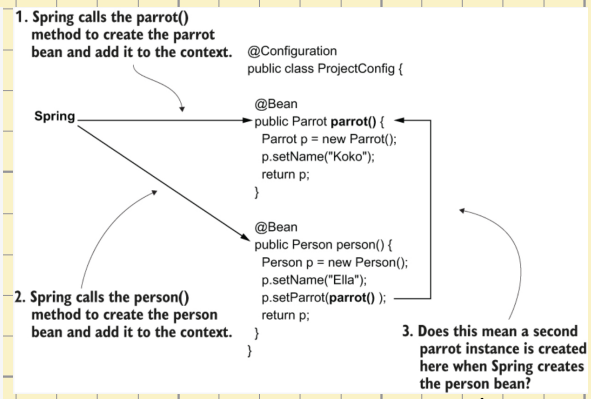
```
@Configuration
public class ProjectConfig {

  @Bean
  public Parrot parrot() {
    Parrot p = new Parrot();
    p.setName("Koko");
    return p;
  }

  @Bean
  public Person person() {
    Person p = new Person();
    p.setName("Ella");
    p.setParrot(parrot());
    return p;
  }
}
```

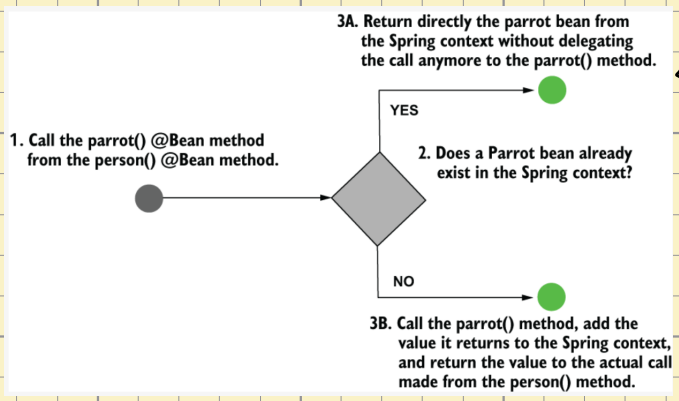
make connection between Parrot and Person

We define the relationship between the person bean and the parrot bean by directly calling the method that returns the bean we want to set.



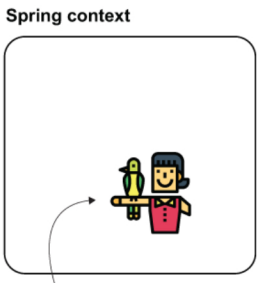
The result is the has-A relationship between the two beans. The person has-A (owns) the parrot.






```
@Configuration
public class ProjectConfig {

  @Bean
  public Parrot parrot() {
    Parrot p = new Parrot();
    p.setName("Koko");
    return p;
  }

  @Bean
  public Person person(Parrot parrot) {
    Person p = new Person();
    p.setName("Ella");
    p.setParrot(parrot);
    return p;
  }
}
```

We instruct Spring to provide a bean from its context by defining a parameter for the method.

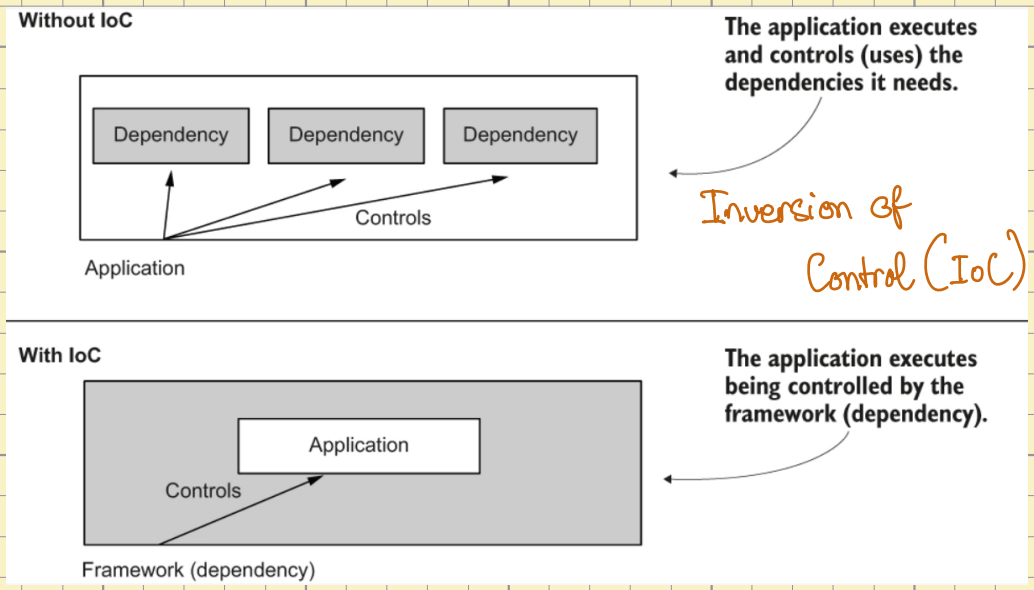


We set the value of the person's attribute with the reference Spring provided.

The result is the has-A relationship between the two beans. The person has-A (owns) the parrot.

this is another way is to wire Beans thru Bean methods' parameters

2) Dependency Injection

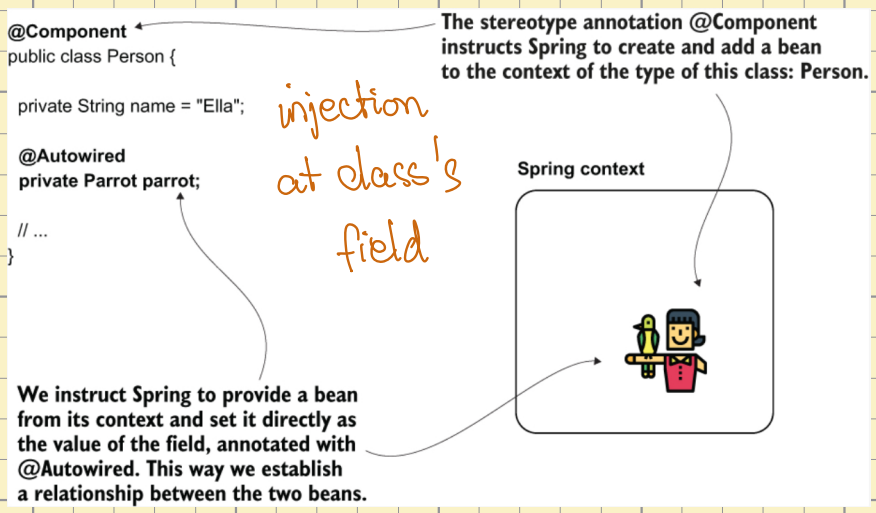


Inversion of Control (IoC)

3 ways to use @Autowired annotation

- inject vals at class fields
- inject value at constructor (* most used)
- inject value at setters (not recommended in production code)

a) inject at class field




```
@Component
public class Person {

  private String name = "Ella";

  @Autowired
  private Parrot parrot;

  // Omitted getters and setters
}
```

```
@Configuration
@ComponentScan(basePackages = "beans")
public class ProjectConfig {

}
```

→ Why is this approach not recommended?

look at this example

```
@Component
public class Person {

  private String name = "Ella";

  @Autowired
  private final Parrot parrot;

}
```

this code will not compile
this will not work b/c final variable has to have a default value (initial)

↳ difficult to manage at initialization

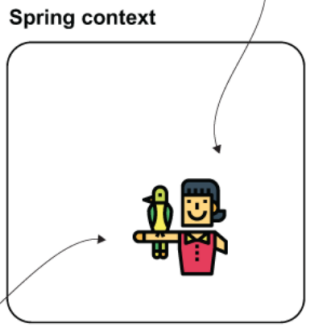
b) inject at class construction (* most suggested)

```
@Component
public class Person {

 private String name = "Ella";

 private final Parrot parrot;

 @Autowired
 public Person(Parrot parrot) {
  this.parrot = parrot;
 }

 // ...

}
```

The stereotype annotation @Component instructs Spring to create and add a bean to the context of the type of this class: Person.

this way is recommended bc we now can set the initial value for final field

make testing easier too



When Spring creates the bean of type Person, it calls the constructor annotated with @Autowired. Spring provides a bean of type Parrot from its context as value of the parameter.

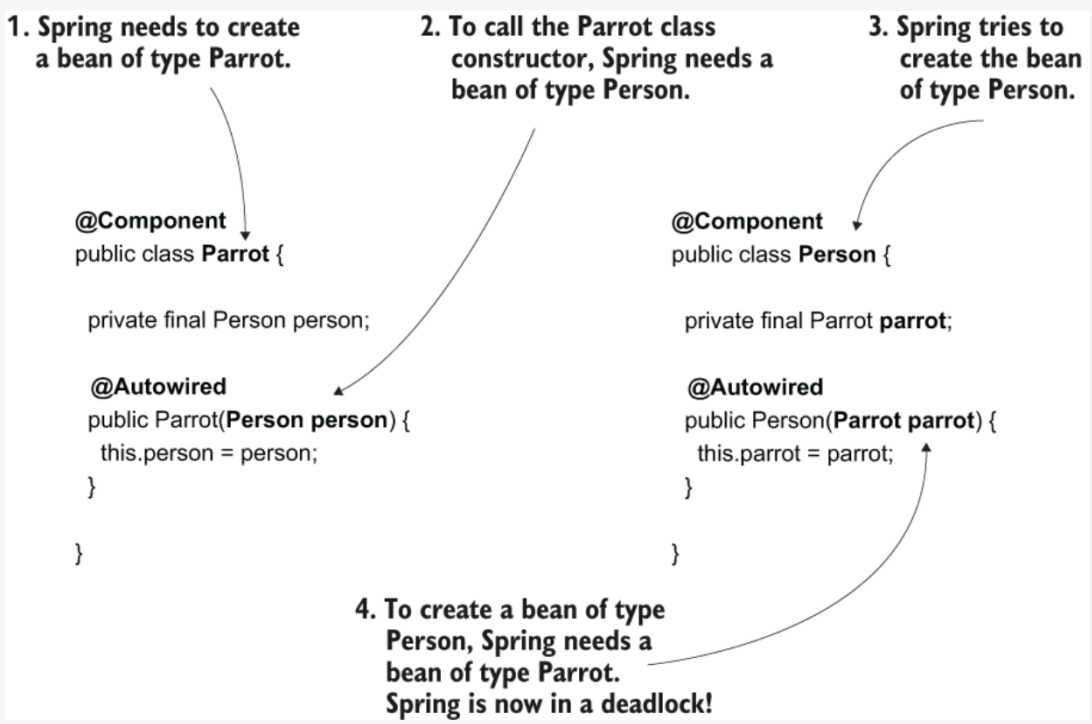
c) inject at setters

- more disadvantages than advantages
- used in old apps

```
@Component
public class Person {

  private String name = "Ella";

  private Parrot parrot;

  // Omitted getters and setters

  @Autowired
  public void setParrot(Parrot parrot) {
    this.parrot = parrot;
  }
}
```

3) Circular Dependencies

- Bean A needs Bean B to construct, but Bean B also requires Bean A during construction
  - → circular dependencies
    - → deadlock



* Solution : rewrite the code

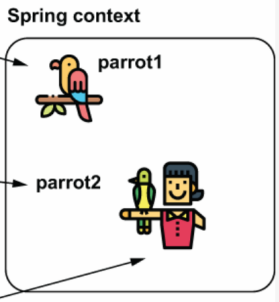
4) Choosing from multiple beans in Spring Context

1. identifier of the parameter is the same

as the name of the bean in Spring context

```
@Configuration
public class ProjectConfig {

  @Bean
  public Parrot parrot1() {
    Parrot p = new Parrot();
    p.setName("Koko");
    return p;
  }

  @Bean
  public Parrot parrot2() {
    Parrot p = new Parrot();
    p.setName("Miki");
    return p;
  }

  @Bean
  public Person person(Parrot parrot2) {
    Person p = new Person();
    p.setName("Ella");
    p.setParrot(parrot2);
    return p;
  }
}
```

In the context, we define two beans of type Parrot. These two beans will take the name of the methods creating them: parrot1 and parrot2. We also define one bean of type Person.



Spring will provide the value of the bean whose name is the same as the name of the parameter we defined.

2. otherwise,

+ use @Primary
+ use @Qualifier e.g @Qualifier ("parrot2") Parrot parrot
+ throw exception

```
@Configuration
public class ProjectConfig {

  @Bean
  public Parrot parrot1() {
    Parrot p = new Parrot();
    p.setName("Koko");
    return p;
  }

  @Bean
  public Parrot parrot2() {
    Parrot p = new Parrot();
    p.setName("Miki");
    return p;
  }

  @Bean
  public Person person(
    @Qualifier("parrot2") Parrot parrot) {

    Person p = new Person();
    p.setName("Ella");
    p.setParrot(parrot);
    return p;
  }
}
```