Presents

Spring Framework

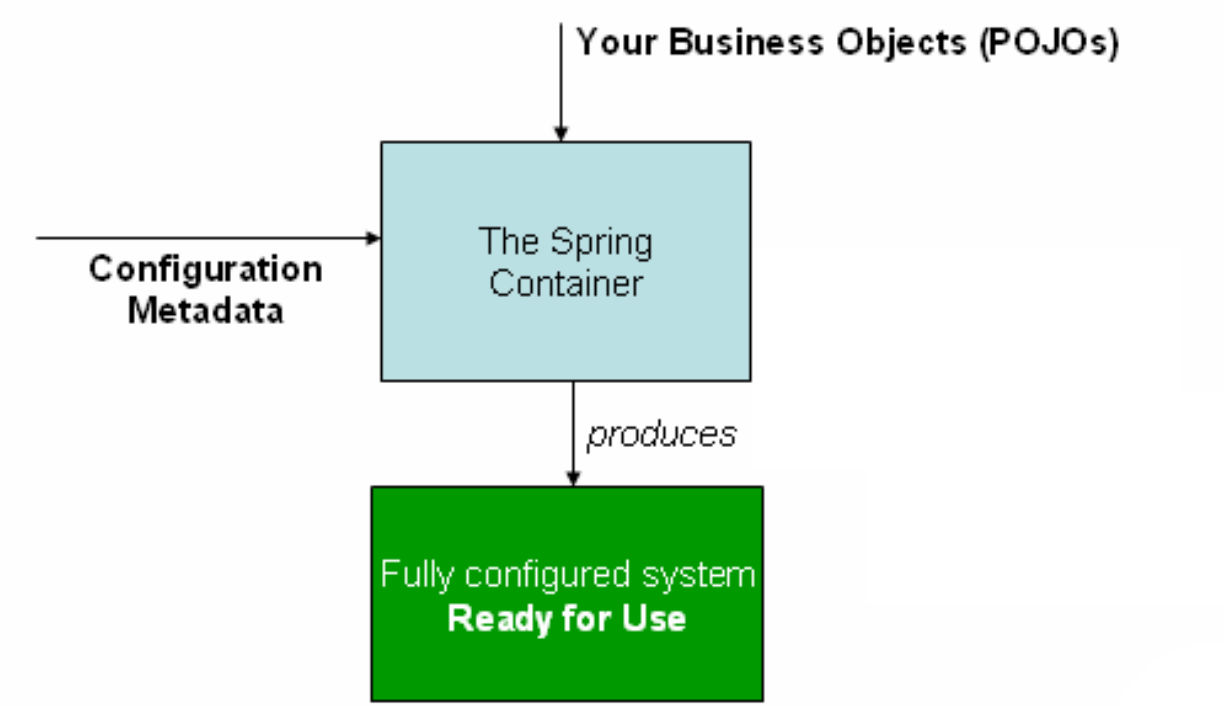
Inversion of Control

- Objects define their dependencies only through
  - ✓ Arguments to the object constructor
  - ✓ Arguments to a factory method
  - ✓ Properties set on an instance by a factory method
- Implementing the dependencies is done via DI
  - ✓ Commonly done in constructors or setter methods
  - ✓ Dependencies are “injected” during or after the instance is created
- IoC means that the instance controls the creation of its dependencies or connections to existing instances it depends on

Spring Container

- Responsible for:
  - ✓ Creating, configuring and wiring beans together
  - ✓ Metadata is read from an XML configuration file
  - ✓ Configuration file may direct the container to scan the code for additional metadata contained in Java annotations
- The container is made up of
  - ✓ A bean factory that manages the beans
  - ✓ A Spring context that provides additional functionality
- The context used depends on the application type
  - ✓ Application contexts are for stand alone applications
  - ✓ Web contexts are for web-based applications

Spring Container



Creating a Container

```
public static void main(String[] args) {
ClassPathXmlApplicationContext context =
            new ClassPathXmlApplicationContext("config.xml");
// working with beans
context.close();
```

Spring Beans

- A Spring bean is an instance of a POJO created the container that has been configured using the supplied metadata
- A “Bean Definition” consists of:
  - ✓ The class name for the POJO to be implemented
  - ✓ The scope and lifecycle of the bean
  - ✓ Reference to other beans needed to satisfy dependencies
  - ✓ Runtime settings like size limits
- Beans have a unique name
  - ✓ Can be defined in the metadata
  - ✓ Defaults to the name of the Java class

Defining a Named Bean

- The code below defines a bean named “SpinDoctor” using the PRWhiz Java class.

```
@Component("SpinDoctor")
public class PRWhiz implements Consultant {

    @Override
    public String getAdvice() {
        return "Don't let them see you sweat";
    }
}
```

Default Name for a Bean

- The code below defines a bean named “ITGuru” by using the Java class name by default

```
@Component
public class ITGuru implements Consultant {

    @Override
    public String getAdvice() {
        return "Turn it off and on again";
    }
}
```

Interfaces

- A bean may be implemented by different Java classes
  - ✓ For example, different versions of the class
- In order to decouple the client logic from the container internals
  - ✓ Beans are referenced in the client code by a Java Interface reference
  - ✓ Every class that is used for making a bean must implement an interface known to the container
- This is consistent with programming best practices

Getting a Bean

- We get a reference to a bean by asking the container for a bean by referencing a specific name
  - ✓ It may provide a reference to an existing instance
  - ✓ It may create a new instance

```
public static void main(String[] args) {
ClassPathXmlApplicationContext context =
            new ClassPathXmlApplicationContext("config.xml");


Consultant dilbert = context.getBean("ITGuru",Consultant.class);
Consultant ratbert =  context.getBean("SpinDoctor",Consultant.class);
```

Bean Lifecycle

- By default, a bean is a singleton
  - ✓ That means if we ask for a refence to a bean and an instance already exists, we get a reference to that bean
  - ✓ At any time, there exists only one copy of the bean
  - ✓ One reason for this is to avoid creating multiple copies of a resource during dependency resolution – use existing resources instead
  - ✓ This is explored in one of the labs
- We can specify other lifecycles
  - ✓ If the “Prototype” scope is declared, ever request for a reference to a bean creates a new instance of the bean
  - ✓ The discussion of other aspects of lifecycle management is beyond the scope of the course

Bean Scope

- In this definition, the @Scope() annotation is used to ensure a new copy of the bean is created each time a bean is requested.

```
@Component
@Scope("prototype")
public class ITGuru implements Consultant {

    @Override
    public String getAdvice() {
        return "Turn it off and on again";
    }
}
```

Dependency Injection

- A bean may be dependent on other beans
  - ✓ This dependencies are identified by the @Autowired annotation
  - ✓ Once dependence is identified by Spring, it scans for a bean that implements the interface in the dependency
  - ✓ One a bean is instantiated, Spring either creates or gets a reference to an existing bean that satisfies that dependency
- Two common kinds of DI
  - ✓ Constructor injection: the dependency is identified in the constructor and resolved when the Java object is created
  - ✓ Setter injection: The dependency is identified in a setter method so allow for a looser coupling between instances

Constructor Injection

- In this example, we have a “Manual” bean which is used by an ITGuru bean

```
@Component
public class TechGuide implements Manual {

    @Override
    public String lookup() {
        return "Just a sec ... Googling it.";
    }

}
```

Constructor Injection

- In the ITGuru bean, we tell Spring we need an instance of a bean that implements the “Manual” interface

```
@Component
public class ITGuru implements Consultant {

    private Manual myManual;

    @Autowired
    public ITGuru(Manual m ) {
        this.myManual = m;
    }

    @Override
    public String getAdvice() {
        return this.myManual.lookup();
    }
}
```

Dependency Injection

- The dependency is defined in terms of an interface
  - ✓ This decouples the client bean from any specific implementation of a manual
- In this example, only one TechManual object needs to be present that all the ITGuru objects can share
  - ✓ When a bean is used in this way, it is often called a service
  - ✓ We generally only need a single copy of a service

Summary

- This module has introduced the basic concepts in the Spring core framework
  - ✓ Spring uses containers to implement IoC
  - ✓ Manages and coordinates Java objects
  - ✓ Resolves and implements dependencies
  - ✓ Manages the lifecycles of the Java objects
- There is a lot more to the Spring framework
  - ✓ Discussion in depth or of other modules and projects in the Spring platform is beyond the scope this first introduction