Session-21

Spring introduction and modules

1. Introduction to Spring Framework

This spring tutorial provides in-depth concepts of Spring Framework with simplified examples. It was **developed by Rod Johnson in 2003**. Spring framework makes the easy development of JavaEE application.

Spring is a lightweight framework. It can be thought of as a framework of frameworks because it provides support to various frameworks such as Struts, Hibernate, Tapestry, EJB, JSF, etc. The framework, in broader sense, can be defined as a structure where we find solution of the various technical problems.

The Spring framework comprises several modules such as IOC, AOP, DAO, Context, ORM, WEB MVC etc. We will learn these modules in next page. Let's understand the IOC and Dependency Injection first.

Spring Framework is a Java platform that provides comprehensive infrastructure support for developing Java applications. Spring handles the infrastructure so you can focus on your application.

Spring enables you to build applications from “plain old Java objects” (POJOs) and to apply enterprise services non-invasively to POJOs. This capability applies to the Java SE programming model and to full and partial Java EE.

Examples of how you, as an application developer, can use the Spring platform advantage:

- Make a Java method execute in a database transaction without having to deal with transaction APIs.
- Make a local Java method a remote procedure without having to deal with remote APIs.
- Make a local Java method a management operation without having to deal with JMX APIs.
- Make a local Java method a message handler without having to deal with JMS APIs.

1.1 Dependency Injection and Inversion of Control

Java applications -- a loose term that runs the gamut from constrained applets to n-tier server-side enterprise applications -- typically consist of objects that collaborate to form the application proper. Thus the objects in an application have dependencies on each other.

Although the Java platform provides a wealth of application development functionality, it lacks the means to organize the basic building blocks into a coherent whole, leaving that task to architects and developers. True, you can use design patterns such as Factory, Abstract Factory, Builder, Decorator, and Service Locator to compose the various classes and object instances that make up an application. However, these patterns are simply that: best practices given a name, with a description of what the pattern does, where to apply it, the problems it addresses, and so forth. Patterns are formalized best practices that you must implement yourself in your application.

The Spring Framework Inversion of Control (IoC) component addresses this concern by providing a formalized means of composing disparate components into a fully working application ready for use. The Spring Framework codifies formalized design patterns as first-class objects that you can integrate into your own application(s). Numerous organizations and institutions use the Spring Framework in this manner to engineer robust, maintainable applications.

Example: Inversion Of Control (IOC) and Dependency Injection

These are the design patterns that are used to remove dependency from the programming code. They make the code easier to test and maintain. Let's understand this with the following code:

```
class Employee{
Address address;
Employee(){
address=new Address();  }
}
```

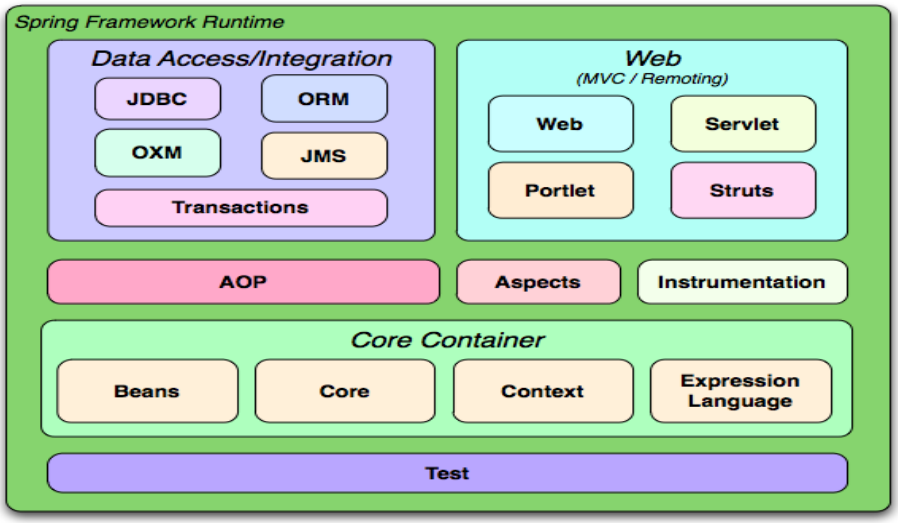
In such case, there is dependency between the Employee and Address (tight coupling). In the Inversion of Control scenario, we do this something like this:

```
class Employee{
Address address;
Employee(Address address){
this.address=address;  }
}
```

Thus, IOC makes the code loosely coupled. In such case, there is no need to modify the code if our logic is moved to new environment.

1.2 Modules

The Spring Framework consists of features organized into about 20 modules. These modules are grouped into Core Container, Data Access/Integration, Web, AOP (Aspect Oriented Programming), Instrumentation, and Test, as shown in the following diagram.



Overview of the Spring Framework

1.2.1 Core Container

The Core Container consists of the Core, Beans, Context, and Expression Language modules.

The Core and Beans modules provide the fundamental parts of the framework, including the IoC and Dependency Injection features. The BeanFactory is a sophisticated implementation of the factory pattern. It removes the need for programmatic singletons and allows you to decouple the configuration and specification of dependencies from your actual program logic.

The Context module builds on the solid base provided by the Core and Beans modules: it is a means to access objects in a framework-style manner that is similar to a JNDI registry. The Context module inherits its features from the Beans module and adds support for internationalization (using, for example, resource bundles), event-propagation, resource-loading, and the transparent creation of contexts by, for example, a servlet container. The Context module also supports Java EE features such as EJB, JMX ,and basic remoting. The ApplicationContext interface is the focal point of the Context module.

The Expression Language module provides a powerful expression language for querying and manipulating an object graph at runtime. It is an extension of the unified expression language (unified EL) as specified in the JSP 2.1 specification. The language supports setting and getting property values, property assignment, method invocation, accessing the context of arrays, collections and indexers, logical and arithmetic operators, named variables, and retrieval of objects by name from Spring's IoC container. It also supports list projection and selection as well as common list aggregations.

1.2.2 Data Access/Integration

The Data Access/Integration layer consists of the JDBC, ORM, OXM, JMS and Transaction modules.

The JDBC module provides a JDBC-abstraction layer that removes the need to do tedious JDBC coding and parsing of database-vendor specific error codes.

The ORM module provides integration layers for popular object-relational mapping APIs, including JPA, JDO, Hibernate, and iBatis. Using the ORM package you can use all of these O/R-mapping frameworks in combination with all of the other features Spring offers, such as the simple declarative transaction management feature mentioned previously.

The OXM module provides an abstraction layer that supports Object/XML mapping implementations for JAXB, Castor, XMLBeans, JiBX and XStream.

The Java Messaging Service (JMS) module contains features for producing and consuming messages.

The Transaction module supports programmatic and declarative transaction management for classes that implement special interfaces and for all your POJOs (plain old Java objects).

1.2.3 Web

The Web layer consists of the Web, Web-Servlet, Web-Struts, and Web-Portlet modules.

Spring's Web module provides basic web-oriented integration features such as multipart file-upload functionality and the initialization of the IoC container using servlet listeners and a web-oriented application context. It also contains the web-related parts of Spring's remoting support.

The Web-Servlet module contains Spring's model-view-controller (MVC) implementation for web applications. Spring's MVC framework provides a clean separation between domain model code and web forms, and integrates with all the other features of the Spring Framework.

The Web-Struts module contains the support classes for integrating a classic Struts web tier within a Spring application. Note that this support is now deprecated as of Spring 3.0. Consider migrating your application to Struts 2.0 and its Spring integration or to a Spring MVC solution.

The Web-Portlet module provides the MVC implementation to be used in a portlet environment and mirrors the functionality of Web-Servlet module.

1.2.4 AOP and Instrumentation

Spring's AOP module provides an AOP Alliance-compliant aspect-oriented programming implementation allowing you to define, for example, method-interceptors and pointcuts to cleanly decouple code that implements functionality that should be separated. Using source-level metadata functionality, you can also incorporate behavioral information into your code, in a manner similar to that of .NET attributes.

The separate Aspects module provides integration with AspectJ.

The Instrumentation module provides class instrumentation support and classloader implementations to be used in certain application servers.

1.2.5 Test

The Test module supports the testing of Spring components with JUnit or TestNG. It provides consistent loading of Spring ApplicationContexts and caching of those contexts. It also provides mock objects that you can use to test your code in isolation.