1. What are the benefits of Spring?

- **Lightweight:** Spring is lightweight in resource use, with the basic Spring Framework only costing 2MB of storage.
- **Scalable:** Spring's transaction management interface can scale to either a local transaction on a single database to global transactions using the JTA module
- **Exception Handling:** Exception handling is easy thanks to plentiful API resources for handling exceptions in each module.
- **Layered Architecture:** Allows you to use the parts of the program you need and discard the rest.
- **POJO Enabled:** Plain Old Java Object Programming allows you continuous testability and integration.
- **Open-source:** Free for everyone and has no vendor lock-in.
- **Inversion of control (IOC):** Achieves loose coupling via IOC by allowing objects to give their dependencies to other objects rather without dependent objects.
- **Aspect oriented (AOP):** Spring supports Aspect-oriented programming, a paradigm that separates application business logic from system services.

2. What is the configuration file for Spring?

The configuration file for Spring is an `XML` file that contains the class information for a project. They describe the configuration of each class, how they're introduced to other classes, and dependencies across the program.

3. What are the different modules of Spring Framework?

There are around 20 modules in total and are divided into the layers of Core Container, Data Access/Integration, Web, AOP (Aspect Oriented Programming), Instrumentation, and Test.

- **Core Container:** The core of the Spring Framework contains 4 modules.
    - Spring Core
    - Spring Bean
    - SpEL (Spring Expression Language)
    - Spring Context
- **Data Access/Integration:** Supports database interactions with 5 modules.
    - JDBC (Java DataBase Connectivity)
    - ORM (Object Relational Mapping)
    - OXM (Object XML Mappers)
    - JMS (Java Messaging Service)
    - Transaction

- **Web:** Adds support for creating a web application using 4 modules.
    - Web
    - Web – MVC
    - Web – Socket
    - Web – Portlet
- **Aspect-Oriented Programming:** This layer allows you to decouple code using Advice and Pointcut functions.
- **Instrumentation:** This layer adds support for class instrumentation and classloader implementations.
- **Test:** Adds support for testing using Junit and TestNG.
- **Miscellaneous:** 2 modules exist outside of these layer categories.
    - **Aspects:** Allows Spring to integrate with Aspect.
    - **Messaging:** Adds support for STOMP, an annotation programming model, and allows you to route STOMP messages from WebSocket clients.

4. What are the different components of a Spring application?

Spring applications contain 5 components:

- **Interface:** Defines program functions.
- **Bean class:** Contains properties, setter and getter methods for accessing the bean, and specific functions, etc.
- **Spring Aspect-Oriented Programming (AOP):** Includes cross-cutting concerns functionality, which is not supported in Object-Oriented Programming.
- **Bean Configuration File:** Contains the information of classes, how to configure them, and defines their relationships.
- **User program:** Calls functions across the program

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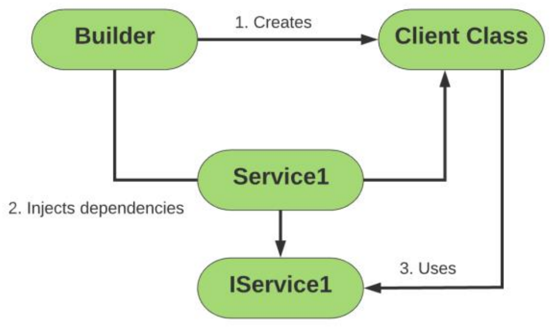
5. What is dependency injection?

Dependency injection (DI) is a concept that defines how multiple classes should be connected. This is one example of Inversion of Control. You don't need to connect services and components explicitly in code when using dependency injection. Instead, you describe the services needed by each component in an `XML` configuration file and allow the IOC container to connect them automatically.



6. What is a Spring IoC container?

An IoC container creates, configures, and connects objects while also managing their lifecycle. The container gets instructions on these areas from configuration metadata given by the user.

7. What are the types of IoC?

- **BeanFactory Container:** This factory class contains a prepackaged collection of beans that instantiate when called by clients. This is the most basic container to support DI.
- **ApplicationContext Container:** Built on top of the BeanFactory Container, this container provides additional enterprise-focused functionalities. For example, ApplicationContext containers grant the ability to resolve textual messages and publish application events.

8. What is Aspect-Oriented Programming (AOP)?

AOP is a programming technique that allows programmers to modularize behavior that is used across the typical divisions of responsibility found in Object-Oriented Programming. The core AOP construct of **aspects** are behaviors applicable across classes. Extracting these behaviors from individual beans to aspects allows them to be reused easily.

9. What are Spring beans?

Beans are objects created from configuration metadata when it is passed to the IOC container. They form the foundation of all Spring programs. The IOC container instantiates, configures, connects, and manages each bean.

10. What are the common implementations of the ApplicationContext?

Three of the most popular containers are:

- **FileSystemXmlApplicationContext:** Causes the constructor to load bean definitions from an XML configuration file. Must be pointed to with a full file path.
- **ClassPathXmlApplicationContext:** This container does the same as the above but does not require a full file path. Instead, you set the `CLASSPATH` property and allow the container to find the `XML` at that `CLASSPATH`.
- **WebXmlApplicationContext:** Loads all bean definitions to a web application from an `XML` file.

11. What is the difference between BeanFactory and ApplicationContext?

The BeanFactory is a basic, space-efficient container with limited functionality. It is best used for simple tasks or when using low-resource machines.

The ApplicationContext is an advanced, more intensive container with an extended interface and additional capabilities like AOP. This container is best used when you need more functionality than the BeanFactory and have ample resources available on the machine.

12. How do you add a bean in a Spring application?

We must annotate a method: `@Bean` annotation. When JavaConfig encounters this method, it will execute that method and register the return value as a bean within a BeanFactory.

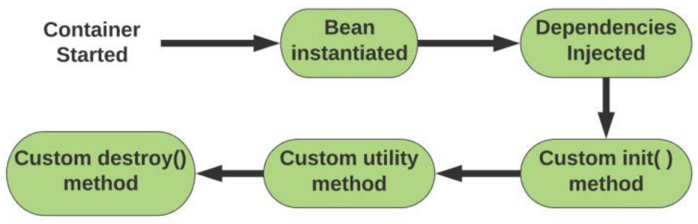
```
package io.educative;

  public class User {

     private String name;
     private String address;

     public String getName() {
        return name;
     }
     public void setName(String name) {
        this.name = name;
     }
     public String getAddress() {
        return address;
     }
     public void setAddress(String address) {
        this.address = address;
     }
  }
```

13. What bean scopes does Spring support?

Spring supports five scopes for beans:

- **Singleton:** Scopes a bean definition to be restricted to a single instance per Spring IoC container
- **Prototype:** Scopes a single bean to enable any number of instances.
- **Request:** Scopes a bean definition to a single HTTP request within an ApplicationContext
- **Session:** Scopes a bean definition to an HTTP session within an ApplicationContext
- **Global-session:** Scopes a bean definition to a Global HTTP

14. What are the steps of the Bean lifecycle?



There are seven steps to the Bean lifecycle:

1. **Instantiate:** The bean is instantiated by the Spring container using the bean's definition found in the `XML` configuration file.
2. **Populate properties:** Spring populates all the defined properties from the `XML` file using dependency injection.
3. **Set Bean Name:** Spring passes the bean's identifier to the `setBeanName()` method If the bean uses the `BeanNameAware` interface.
4. **Set Bean factory:** Spring passes the `beanfactory` to the `setBeanFactory()` method if the bean is configured to use the `BeanFactoryAware` interface.
5. **Pre Initialization:** Spring calls any `BeanPostProcessors` associated with the bean using the `postProcessorBeforeInitialization()` method.
6. **Initialization:** The bean is then initialized. Any special initialization process specified in the `init-method` is followed.
7. **Post Initialization:** All defined `postProcessAfterInitialization()` methods are called. Now the bean is complete. Beans that implement `DisposableBean` will be deleted using the `destroy()` after their job is finished.

15. Explain inner beans in Spring.

An inner bean is used as a property of another bean. Inner beans can be defined in the configuration `XML` file under either the `<property>` or `<constructor-arg>` elements. All inner beans are always scoped as `prototype` and don't have identifiers.

16. What is bean auto wiring?

This is a Spring capability that allows the Spring container to automatically set dependency relationships between collaborating beans by looking at the BeanFactory. Autowiring can be set to define these relationships using the beans' names or type or even class constructors.

17. How can you inject a Java Collection in Spring?

Java collections can be injected in four different ways:

- **`<list>`:** Helps you wire sets of values like lists while allowing duplicates.
- **`<set>`**: Helps you wire a set of values while avoiding duplicates.
- **`<map>`**: Allows you to inject a collection of key-value pairs of any data type.
- **`<props>`:** Allows you to inject a collection of key-value pairs with both keys and values of type `String`.

18. What is a Joinpoint?

Joinpoints represent any point in a program where an action is taken. Examples of a joinpoint include when handling an exception or a method is executed. When using AOP, only method executions are joinpoints.

19. What is an Advice in Spring?

An Advice is the action taken at a given joinpoint. AOP uses an Advice as an interceptor before the method's execution is complete.

20. What are the types of advice for a Spring Framework?

- **Before:** These are advices that execute before the joinpoint methods. They're marked using the `@Before` annotation mark.
- **After returning:** These execute after the joinpoint's method completes executing without issue. They're marked using the `@AfterReturning` annotation mark.
- **After throwing:** These execute only if the joinpoint method ends by throwing an exception. They're marked using the `@AfterThrowing` annotation mark.
- **After:** These execute after a joinpoint method, regardless of how it completes. They're marked using the `@After` annotation mark.
- **Around:** These execute before and after a joinpoint and are marked using the `@Around` annotation mark.

21. What is Weaving?

Weaving in Spring is the process of linking elements to other application types or objects to create advised objects. This is done at runtime.

22. Describe Spring DAO support.

Data Access Object (DAO) support is a set of tools that make it easier to work with data access technologies like Hibernate and JDO with improved consistency. It also catches technology-specific errors automatically. Together these make DAOs easier to work with and allows you to switch between persistence technologies without error.

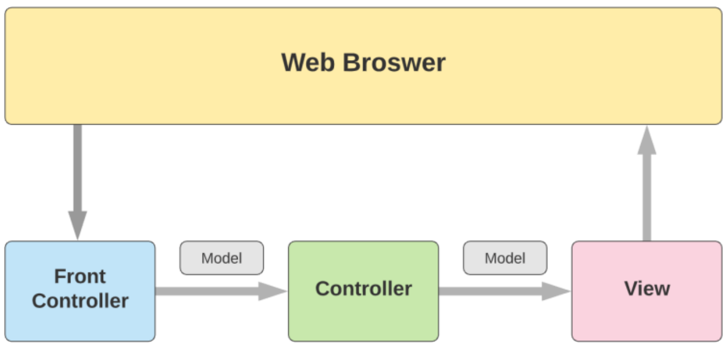
23. What is the JDBC? Which classes are present in the Spring JDBC API?

JDBC stands for Java Database Connectivity. It is an application programming interface in Java used to define how a program may access a database. The JDBC API contains:

- `JdbcTemplate`
- `NamedParameterJdbcTemplate`
- `SimpleJdbcCall`
- `SimpleJdbcInsert`
- `SimpleJdbcTemplate`

24. What is the Spring Model-View-Controller (MVC) framework?

The Spring MVC framework provides model-view-controller architecture and premade components used to develop loosely coupled web applications. Using MVC you can separate different aspects of the program like a business, input, and UI logics while still having a loose coupling between each. This allows for greater flexibility in your web applications.



25. What are the parts of Spring MVC framework?

The 3 main parts of MVC are:

- **DispatcherServlet:** This part of MVC manages all the HTTP requests, and responses that interact with the program. The `DispatcherServlet` first receives relevant handler mapping from the configuration file and then passes off the request to the controller. The `DispatcherServlet` is the most important part of the Spring Web MVC framework.
- **WebApplicationContext:** This acts as an extension of the plain ApplicationContext with extra features necessary for web applications. It can uniquely resolve themes and automatically decide which servlet it is associated with.
- **Controllers:** These are beans within the `DispatcherServlet` that act as filters between user input and application response. Controllers take user input, decide if it should be transformed into either a View or a Model, and finally returns the transformed input to the View Resolver for review.

26. What are the different parts of the DispatcherServlet?

1. **Handler Mapping:** An interface that defines the mapping between handler and request objects. Can be used to create a custom mapping strategy.
2. **Controller:** Determines the app’s response to user input by sorting input requests by their desired outcome. Input is either immediately returned with a View or is transformed into a Model before being passed to the view-resolver.
3. **View-Resolver:** Takes and renders Models from the controller by mapping between View names and actual Views.

27. How can annotation wiring be turned on in Spring?

To allow annotation wiring, include `<context:annotation-config/>` in your `XML` configuration file:

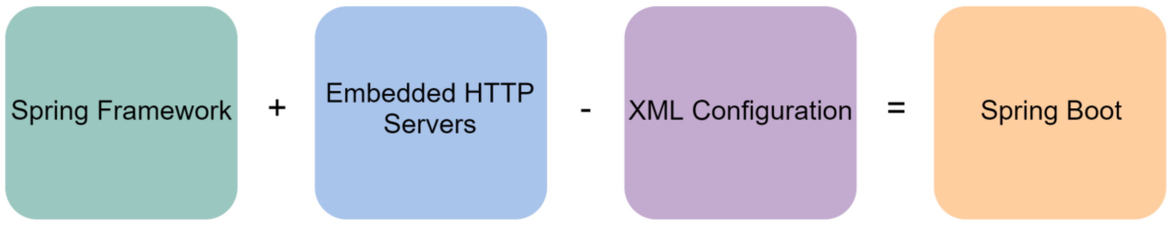
```
<beans
    //...
    xmlns:context="http://www.springframework.org/schema/context"
    //...
    http://www.springframework.org/schema/context
    http://www.springframework.org/schema/context/spring-context-2.5.xsd">
    //...

    <context:annotation-config /> //annotation wiring enabled here
    //...
</beans>
```

28. What is the Spring Boot?

Spring Boot is an open-source Java framework used to create microservices. It is a project built on top of Spring to simplify the task of deploying Java applications. Its two major components are the Spring Framework and Embedded HTTP Servers. Spring Boot is used to:

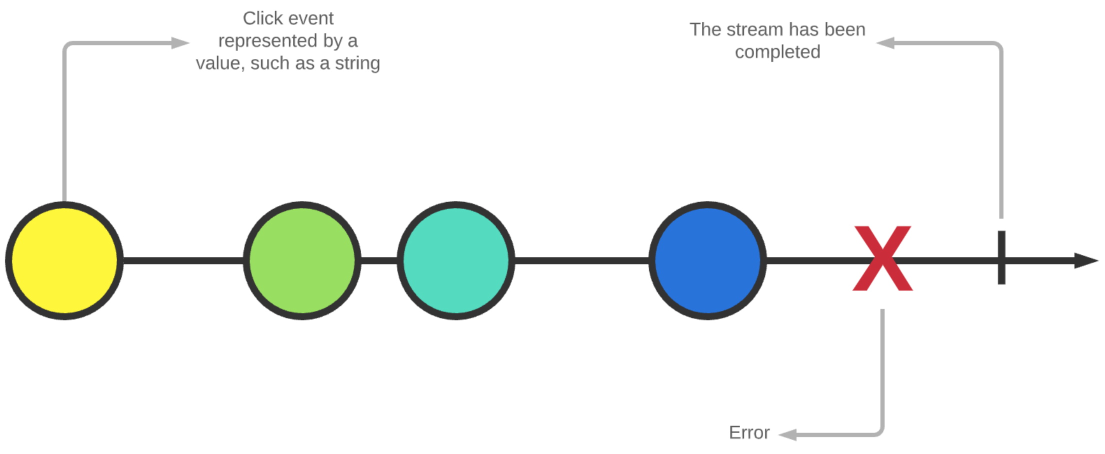
- Simplify the process of developing production-ready Spring applications
- Avoid `XML` configuration in Spring
- Reduce development time by decreasing the number of needed import statements
- Provide an opinionated development approach

These are often used to get Spring applications running quickly.



29. What is Reactive Programming?

Reactive Programming is a programming paradigm that relies on programmed actions trigger on events rather than based on the chronological order of the code. Reactive programs make efficient use of computer resources and scale well with just a few threads. Its non-sequential form allows you to avoid stack blocking and maintain responsiveness.


Click event represented by a value, such as a string
The stream has been completed
Error

.

34. What is a Proxy in Spring?

A Proxy is an object created after applying advice to a target object. Proxies are used to perform meta-programming operations like intercepting an object call or altering an object's property.

35. When is the target object and proxy object the same?

This is a "gotcha" question used to test if you know how different object types interact. The target and proxy objects are the *same* when dealing with client objects.

36. How can configuration metadata be provided to the Spring container?

XML-Based Configuration: This type of configuration stores all of a program's bean definitions and dependencies in an `XML` file. These files are imported by providing a full file path, like on line 1 below.

```
<bean id="bean1" class="io.Educative.firstSpring.Bean1">
 <property name="name" value="Educative"></property>
</bean>
```

Annotation-Based Configuration: You can instead create annotations on a class, method, or field in a bean to position it within a component class.

```
<beans>
<context:annotation-config/>
<!-- bean definitions go here -->
</beans>
```

Java-Based Configuration: This type of configuration allows you to skip `<bean>` syntax and instead use the `@Bean` tag to achieve the same thing. You can also create configuration classes with the `@Configuration` tag, allowing you to create dependencies between beans by calling other`@Bean` classes.

```
@Configuration
public class BeanConfig
{
@Bean
public Bean1 myBean()
{ return new Bean1(); }
}
```

37. What are the possible exceptions that can be thrown by Spring DAO classes?

- `DataAccessResourceFailureException`
- `CleanUpFailureDataAccessException`
- `InvalidDataAccessApiUsageException`
- `InvalidDataAccessResourceUsageException`
- `UncategorizedDataAccessException`
- `DataIntegrityViolationException`
- `DeadLockLoserDatAccessException`
- `OptimisticLockingFailureEexception`
- `IncorrectUpdateSemanticsDataAccessException`
- `TypeMismatchDataAccessException`
- `ObjectRetrievalFailureException`
- `DataRetrievalFailureException`

38. What are the ways Hibernate can be accessed using Spring?

Hibernate ORM is an object-relational mapping framework for Java. It is used with Spring to map object-oriented domain models to a relational database. Hibernate can be accessed in Spring in the following two ways:

1. First, extend `HibernateDAOSupport` and then apply an AOP Interceptor node
2. Use Inversion of Control with Hibernate Template and Callback structures

39. Point out the difference between concern and cross-cutting concern in Spring AOP?

A concern is the target functionality we're trying to implement into a *particular* module of our application.

A cross-cutting concern is a concern that is used across the entire application rather than just in a particular module.

Data logging is a good example of a cross-cutting concern as logging is useful and desired regardless of what module it is in.

40. What are the types of transaction management available in Spring?

Declarative transaction management: This type manages transactions using annotations or `XML` configurations to separate transaction management from the program's business code. While easy to maintain, this style is more restricted in its capabilities.

Programmatic transaction management: This type manages transactions with specifically made programs. The customization of these programs allows for more flexible management but introduces more room for error in the process.