Spring-boot

Spring core questions ?

Bean validation in spring ?

**What is Bean Validation in Java?**

**Bean Validation** is a mechanism for validating Java objects using annotations. It ensures that **data constraints** (like @NotNull, @Size, etc.) are enforced automatically before processing data.

It is part of **Jakarta Bean Validation (formerly Java EE)** and implemented by frameworks like **Hibernate Validator** (default implementation for Spring Boot and Java EE).

**Key Features of Bean Validation**

1. **Annotation-Based Constraints** (e.g., @NotNull, @Size)
2. **Custom Validations** using @Constraint
3. **Groups for Conditional Validation**
4. **Integration with JPA, Spring Boot, and Jakarta EE**
5. **Programmatic API for manual validation**

**Example Usage of Bean Validation**

**1️⃣ Using Built-in Annotations**

import jakarta.validation.constraints.\*;

public class User {

@NotNull(message = "Name cannot be null")

private String name;

@Min(value = 18, message = "Age must be at least 18")

private int age;

@Email(message = "Invalid email format")

private String email;

// Constructors, Getters, Setters

}

**2️⃣ Validating with Validator API**

import jakarta.validation.\*;

import java.util.Set;

public class ValidationExample {

public static void main(String[] args) {

User user = new User(null, 16, "invalid-email");

ValidatorFactory factory = Validation.buildDefaultValidatorFactory();

Validator validator = factory.getValidator();

Set<ConstraintViolation<User>> violations = validator.validate(user);

for (ConstraintViolation<User> violation : violations) {

System.out.println(violation.getMessage());

}

}

}

✅ **Output:**

Name cannot be null

Age must be at least 18

Invalid email format

**Common Bean Validation Annotations**

| **Annotation** | **Description** |
| --- | --- |
| @NotNull | Field cannot be null |
| @Size(min, max) | Limits string length |
| @Min(value) | Minimum numeric value |
| @Max(value) | Maximum numeric value |
| @Email | Validates email format |
| @Pattern(regex) | Validates using regex |
| @Past / @Future | Ensures date is in past/future |

**3️⃣ Using Bean Validation in Spring Boot**

* **Spring Boot** automatically validates request bodies using @Valid.

@RestController

@RequestMapping("/users")

public class UserController {

@PostMapping

public ResponseEntity<String> createUser(@Valid @RequestBody User user) {

return ResponseEntity.ok("User created successfully!");

}

}

**Conclusion**

Bean Validation helps **automate data validation**, ensuring **consistency and reliability** across Java applications. 🚀

Here are some common **Spring Framework interview questions** that cover a broad range of topics. These questions are typically asked to test your knowledge of key Spring concepts, how well you understand Spring's features, and how you apply them in real-world scenarios.

Exception Handling:

TYPES:

1.Traditional exceptional handling using (Using try catch)

try catch for Rest Api.

@GetMapping("/getProductById/{productId}")

public ResponseEntity<?> getBookById(@PathVariable("productId") Integer productId) {

try {

Product product = productService.findById(productId)

.orElseThrow(() -> new ProductNotFoundException("Product not found with id: " + productId));

return ResponseEntity.ok(product);

} catch (ProductNotFoundException ex) {

Map<String, Object> errorBody = new HashMap<>();

errorBody.put("timestamp", java.time.LocalDateTime.now());

errorBody.put("message", ex.getMessage());

errorBody.put("details", "Product Not Found");

return new ResponseEntity<>(errorBody, HttpStatus.NOT\_FOUND);

}

}

2.

Exception handler(without try catch) in same controller class(works only for product controller or only for order controller).

@GetMapping("/getProductById/{productId}")

public ResponseEntity<Product> getBookById(@PathVariable("productId") Integer productId) {

Product product = productService.findById(productId)

.orElseThrow(() -> new ProductNotFoundException("Product not found with id: " + productId));

return ResponseEntity.ok(product);

}

2.2

@ExceptionHandler(ProductNotFoundException.class)

public ResponseEntity<> handleProductNotFoundException(ProductNotFoundException exception){

ErrorResponse productNotFound = new ErrorResponse(LocalDateTime.now(), exception.getMessage(), details: "Product Not Found");

return new ResponseEntity<>(productNotFound, HttpStatus.NOT\_FOUND);

} return new ResponseEntity<>(error, HttpStatus.NOT\_FOUND);

}

3.Controller Advise and implementation.(Global controller works for any).

Create a global controller and add below code.

//you can use @controlleradvise and @restcontrolleradvice  
@controlleradvise-only for returning particular method body.

Ex:

ErrorResponse productNotFound = new ErrorResponse(LocalDateTime.*now*(), exception.getMessage(), "Product Not Found");  
 return new ResponseEntity<>(productNotFound, HttpStatus.*NOT\_FOUND*);

@Restcontrolleradvice

It is for both method response and also other body.

Ex

ErrorResponse productNotFound = new ErrorResponse(LocalDateTime.*now*(), exception.getMessage(), "Product Not Found");  
 return new “Error”;

Main code:

@RestControllerAdvice public class GlobalExceptionHandler {  
  
 @ExceptionHandler(ProductNotFoundException.class)  
 public ResponseEntity<?> handleProductNotFoundException(ProductNotFoundException exception){  
 ErrorResponse productNotFound = new ErrorResponse(LocalDateTime.*now*(), exception.getMessage(), "Product Not Found");  
 return new ResponseEntity<>(productNotFound, HttpStatus.*NOT\_FOUND*);  
 }

Caching in springboot.

**Cache in Spring Boot**

Caching in **Spring Boot** is a mechanism to store frequently used data in memory so that it can be retrieved quickly without repeatedly querying a database or an external service. This improves the performance and reduces the load on the system.

Ex:

1.enable cache.

@Configuration  
@EnableCaching  
public class AppConfig {  
}

2.add cachable

@Cacheable(value = "weather", key = "#city")  
public String getWeatherByCity(String city) {  
 System.*out*.println("Fetching data from DB for city: " + city);  
 Optional<Weather> weather = weatherRepository.findByCity(city);  
 return weather.map(Weather::getForecast).orElse("Weather data not available");  
}

Types of caching:

1.inmemory

2.distributed

3.inspect caching(check caced data)

public void printCacheContents(String cacheName) {  
 Cache cache = cacheManager.getCache(cacheName);

if (cache != null) {  
 System.*out*.println("Cache Contents:");  
 System.*out*.println(Objects.*requireNonNull*(cache.getNativeCache()).toString());  
 } else {  
 System.*out*.println("No such cache: " + cacheName);  
 }  
 }  
}

4.updating data but after updated showing cached data not data returned from database of get city.

Even after adding put map if we don’t add key=#city in both @cacheble and @putcachining it wot work.

Example:Cacheput.

@CachePut(value = "weather",key = "#city")  
public String updateWeather(String city, String updatedWeather) {  
 weatherRepository.findByCity(city).ifPresent(weather -> {  
 weather.setForecast(updatedWeather);  
 weatherRepository.save(weather);  
 });  
 return updatedWeather;  
}

--------cacheble for getweather-------------

@Cacheable(value = "weather", key = "#city")  
public String getWeatherByCity(String city) {  
 System.*out*.println("Fetching data from DB for city: " + city);  
 Optional<Weather> weather = weatherRepository.findByCity(city);  
 return weather.map(Weather::getForecast).orElse("Weather data not available");  
}

5.deleting data from cache.so it returns data after deleting from table and also cache.

Delete function delete from only database .but @cacheevict also deletes from the @caching.

If @cacheevict don’t works use key=#city key must be same in @caching,@putPut and @cacheevict

@Transactional  
@CacheEvict(value = "weather",key = "#city")  
public void deleteWeather(String city) {  
 System.*out*.println("Removing weather data for city: " + city);  
 weatherRepository.deleteByCity(city);  
}

Check printing chache data api to see data.

Bean factory vs application context

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**Path Variable (@PathVariable) vs Request Parameter (@RequestParam) in Spring Boot**

| **Feature** | **@PathVariable** | **@RequestParam** |
| --- | --- | --- |
| **Usage** | Extracts values from the **URI path** | Extracts values from **query parameters** |
| **Format** | /users/{id} → /users/10 | /users?id=10 |
| **Optional?** | No (by default, must be provided) | Yes (required = false allows optional parameters) |
| **Data Type** | Can be any data type (int, String, UUID, etc.) | Usually **String** (converted to other types) |
| **Best Use Case** | Identifiers (e.g., user IDs, order numbers) | Filtering, sorting, pagination, optional data |

**Example of @PathVariable**

@RestController

@RequestMapping("/users")

public class UserController {

@GetMapping("/{id}")

public String getUserById(@PathVariable int id) {

return "User ID: " + id;

}

}

✅ **Access:** GET /users/10  
✅ **Output:** "User ID: 10"

**Example of @RequestParam**

@RestController

@RequestMapping("/users")

public class UserController {

@GetMapping

public String getUserByParam(@RequestParam(required = false, defaultValue = "1") int id) {

return "User ID: " + id;

}

}

✅ **Access:** GET /users?id=10  
✅ **Output:** "User ID: 10"  
✅ **Access without parameter (/users)** → Uses defaultValue = "1"

**When to Use What?**

| **Scenario** | **Use** |
| --- | --- |
| Accessing a **specific resource** | @PathVariable |
| **Filtering, sorting, or pagination** | @RequestParam |
| Parameters that are **optional** | @RequestParam with required = false |
| RESTful API Design (resources like /users/{id}) | @PathVariable |

**Conclusion:**

* Use **@PathVariable** for fixed parts of the URL.
* Use **@RequestParam** for dynamic query parameters. 🚀

**BeanFactory vs ApplicationContext in Spring**

| **Feature** | **BeanFactory** | **ApplicationContext** |
| --- | --- | --- |
| **Definition** | Core container interface for managing beans | Advanced container with additional features |
| **Lazy Loading** | Yes, beans are loaded on demand | No, beans are preloaded at startup |
| **Event Handling** | No | Yes, supports event propagation |
| **Internationalization** | No | Yes, supports message sources |
| **AOP & Annotation Support** | Limited | Fully supported |
| **When to Use?** | Lightweight applications where memory is critical | Enterprise applications with additional features |

**Example of BeanFactory**

import org.springframework.beans.factory.BeanFactory;

import org.springframework.beans.factory.xml.XmlBeanFactory;

import org.springframework.core.io.ClassPathResource;

public class BeanFactoryExample {

public static void main(String[] args) {

BeanFactory factory = new XmlBeanFactory(new ClassPathResource("beans.xml"));

MyBean bean = (MyBean) factory.getBean("myBean");

bean.sayHello();

}

}

✅ **Key Points:**

* Uses **lazy loading**, meaning beans are created only when needed.
* Uses XmlBeanFactory (deprecated in Spring 5, replaced by DefaultListableBeanFactory).

**Example of ApplicationContext**

import org.springframework.context.ApplicationContext;

import org.springframework.context.support.ClassPathXmlApplicationContext;

public class ApplicationContextExample {

public static void main(String[] args) {

ApplicationContext context = new ClassPathXmlApplicationContext("beans.xml");

MyBean bean = (MyBean) context.getBean("myBean");

bean.sayHello();

}

}

✅ **Key Points:**

* **Preloads** all beans at startup.
* Supports **event handling**, **AOP**, and **annotation-based configuration**.
* Recommended for **enterprise applications**.

**When to Use What?**

* Use **BeanFactory** for **lightweight applications** with limited memory.
* Use **ApplicationContext** for **full-featured enterprise applications**. 🚀

Jar to war I spring boot?

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**1️⃣ Modify pom.xml (for Maven projects)**

Update the **packaging** type from jar to war:

xml

CopyEdit

<packaging>war</packaging>

Add the **Spring Boot Starter Web dependency** (if not already present):

xml

CopyEdit

<dependency>

<groupId>org.springframework.boot</groupId>

<artifactId>spring-boot-starter-web</artifactId>

</dependency>

Exclude the **embedded Tomcat** from spring-boot-starter-web (since WAR files are deployed to external servers):

xml

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<dependency>

<groupId>org.springframework.boot</groupId>

<artifactId>spring-boot-starter-tomcat</artifactId>

<scope>provided</scope>

</dependency>

Ensure the **Spring Boot Maven Plugin** is included:

xml

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<build>

<plugins>

<plugin>

<groupId>org.springframework.boot</groupId>

<artifactId>spring-boot-maven-plugin</artifactId>

</plugin>

</plugins>

</build>

**2️⃣ Extend SpringBootServletInitializer in Main Class**

Modify the main application class to **extend SpringBootServletInitializer**:

java

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import org.springframework.boot.SpringApplication;

import org.springframework.boot.autoconfigure.SpringBootApplication;

import org.springframework.boot.web.servlet.support.SpringBootServletInitializer;

@SpringBootApplication

public class MyApplication extends SpringBootServletInitializer {

public static void main(String[] args) {

SpringApplication.run(MyApplication.class, args);

}

}

**3️⃣ Build and Deploy the WAR**

To generate the WAR file, run:

sh

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mvn clean package

The WAR file will be generated inside the target/ directory.

Now, you can **deploy** it to an **external Tomcat server** (e.g., webapps/ directory of Tomcat).

Tomcat to jetty in spring boot ?

To switch from **Tomcat** to **Jetty** in a **Spring Boot** application, follow these steps:

**1️⃣ Exclude Embedded Tomcat**

Modify your pom.xml to **remove Tomcat**:

xml

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<dependency>

<groupId>org.springframework.boot</groupId>

<artifactId>spring-boot-starter-web</artifactId>

<exclusions>

<exclusion>

<groupId>org.springframework.boot</groupId>

<artifactId>spring-boot-starter-tomcat</artifactId>

</exclusion>

</exclusions>

</dependency>

**2️⃣ Add Jetty Dependency**

Now, add the **Jetty starter** in pom.xml:

xml

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<dependency>

<groupId>org.springframework.boot</groupId>

<artifactId>spring-boot-starter-jetty</artifactId>

</dependency>

**3️⃣ (Optional) Configure Jetty Settings in application.properties**

You can specify Jetty's port, thread settings, etc.:

properties

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server.port=8081

server.jetty.threads.min=10

server.jetty.threads.max=200

**4️⃣ Rebuild and Run the Application**

Run the following command:

sh

CopyEdit

mvn clean package

mvn spring-boot:run

transactional management in spring boot ?

**Transactional Management in Spring Boot**

Spring Boot provides **transaction management** using **Spring Transactional API**, ensuring **data consistency** in case of failures. It supports **declarative transactions** using the @Transactional annotation and **programmatic transactions** via TransactionTemplate or PlatformTransactionManager.

**1️⃣ Declarative Transaction Management (@Transactional)**

Spring Boot allows **automatic transaction management** using the @Transactional annotation.

**Example: Using @Transactional in a Service Layer**

import org.springframework.stereotype.Service;

import org.springframework.transaction.annotation.Transactional;

@Service

public class EmployeeService {

private final EmployeeRepository employeeRepository;

public EmployeeService(EmployeeRepository employeeRepository) {

this.employeeRepository = employeeRepository;

}

@Transactional

public void createEmployee(Employee employee) {

employeeRepository.save(employee);

// Simulating an exception

if (employee.getName().equals("Error")) {

throw new RuntimeException("Simulated Exception!");

}

}

}

* If an exception occurs, the transaction **rolls back** automatically.
* If everything runs smoothly, it **commits** the transaction.

**2️⃣ Transaction Propagation in Spring Boot**

Spring provides **different propagation types** to control transaction behavior.

| **Propagation Type** | **Description** |
| --- | --- |
| REQUIRED (default) | Uses the existing transaction or creates a new one. |
| REQUIRES\_NEW | Suspends the current transaction and starts a new one. |
| SUPPORTS | Runs within a transaction if it exists, otherwise runs without it. |
| NOT\_SUPPORTED | Runs without a transaction, suspending the current one. |
| MANDATORY | Uses an existing transaction; throws an exception if none exists. |
| NEVER | Must not run in a transaction; throws an exception if one exists. |
| NESTED | Runs within a nested transaction inside the parent transaction. |

**Example: Using Different Propagation Types**

@Transactional(propagation = Propagation.REQUIRES\_NEW)

public void updateEmployee(Employee employee) {

employeeRepository.save(employee);

}

**3️⃣ Rollback for Specific Exceptions**

By default, @Transactional **rolls back on unchecked exceptions** (RuntimeException).  
You can configure it for specific exceptions:

@Transactional(rollbackFor = Exception.class) // Rollback on all exceptions

public void processTransaction() {

// Business logic

}

To prevent rollback for some exceptions:

@Transactional(noRollbackFor = IllegalArgumentException.class)

public void saveData() {

// Will NOT rollback for IllegalArgumentException

}

**4️⃣ Programmatic Transaction Management**

You can also **manually control transactions** using TransactionTemplate:

import org.springframework.transaction.support.TransactionTemplate;

@Service

public class OrderService {

private final TransactionTemplate transactionTemplate;

private final OrderRepository orderRepository;

public OrderService(TransactionTemplate transactionTemplate, OrderRepository orderRepository) {

this.transactionTemplate = transactionTemplate;

this.orderRepository = orderRepository;

}

public void processOrder(Order order) {

transactionTemplate.execute(status -> {

orderRepository.save(order);

if (order.getAmount() < 0) {

status.setRollbackOnly(); // Rollback if amount is invalid

}

return null;

});

}

}

**5️⃣ Global Transaction Management (JTA)**

For **multiple databases**, use **JTA (Java Transaction API)** with **Atomikos**:

**1️⃣ Add Dependencies (pom.xml)**

<dependency>

<groupId>org.springframework.boot</groupId>

<artifactId>spring-boot-starter-jta-atomikos</artifactId>

</dependency>

**2️⃣ Configure DataSources**

spring.jta.enabled=true

**3️⃣ Use @Transactional as Usual**

@Transactional

public void transferMoney(Account from, Account to, double amount) {

accountRepository.debit(from, amount);

accountRepository.credit(to, amount);

}

**✅ Summary**

* Use @Transactional for **automatic transaction management**.
* Supports **different propagation strategies** (REQUIRED, REQUIRES\_NEW, etc.).
* Rollbacks by **default** on RuntimeException, but can be customized.
* Use TransactionTemplate for **manual transactions**.
* **JTA (Atomikos)** allows **global transactions across multiple databases**.

Circular dependency in spring boot?

**How to Fix Circular Dependency in Spring Boot?**

A **circular dependency** in **Spring Boot** occurs when two or more beans **depend on each other**, creating a loop that prevents proper initialization.

**🔍 Example of Circular Dependency**

**Problematic Scenario**

@Service

public class AService {

private final BService bService;

public AService(BService bService) {

this.bService = bService;

}

}

@Service

public class BService {

private final AService aService;

public BService(AService aService) {

this.aService = aService;

}

}

* AService requires BService in the constructor.
* BService requires AService in the constructor.
* This results in **"BeanCurrentlyInCreationException"**.

**✅ Solutions to Fix Circular Dependency**

**1️⃣ Use @Lazy Annotation**

Delays the injection of one of the beans **until it is actually needed**.

@Service

public class AService {

private final BService bService;

public AService(@Lazy BService bService) {

this.bService = bService;

}

}

* BService will only be initialized **when first accessed**, breaking the loop.

**2️⃣ Use @Autowired on Setter Instead of Constructor**

Spring allows **setter-based injection** to break circular dependencies.

@Service

public class AService {

private BService bService;

@Autowired

public void setBService(BService bService) {

this.bService = bService;

}

}

* Now, BService **doesn't need to be created immediately**, solving the issue.

**3️⃣ Use @PostConstruct for Lazy Initialization**

Another approach is **delaying dependency setting** with @PostConstruct.

@Service

public class AService {

private final BService bService;

public AService() {

this.bService = null; // Avoid direct dependency in the constructor

}

@Autowired

public void setBService(BService bService) {

this.bService = bService;

}

@PostConstruct

public void init() {

// Now we can use bService after full initialization

}

}

* Spring will inject BService **after AService is created**.

**4️⃣ Use @Primary to Resolve Multiple Implementations**

If multiple beans exist, use @Primary to let Spring know which one to use.

@Service

@Primary

public class BServiceImpl implements BService {

}

**5️⃣ Use ApplicationContext to Manually Fetch Beans**

Fetch the dependent bean **after Spring has initialized all beans**.

@Service

public class AService implements ApplicationContextAware {

private BService bService;

@Override

public void setApplicationContext(ApplicationContext applicationContext) {

this.bService = applicationContext.getBean(BService.class);

}

}

* BService is **retrieved manually**, breaking the cycle.

**🚀 Best Approach?**

* **Use @Lazy for direct dependencies.**
* **Use setter-based injection (@Autowired on setters) when possible.**
* **For complex cases, @PostConstruct or ApplicationContext can help.**

Would you like me to check for circular dependencies in your code? 😊

Exceotional handling in spring boot.  
**Exception Handling in Spring Boot 🚀**

Spring Boot provides multiple ways to handle exceptions globally and locally, ensuring a clean and user-friendly response.

**1️⃣ Basic Exception Handling Using try-catch**

This is the simplest way to catch exceptions inside a method.

public String getEmployee(int id) {

try {

return employeeRepository.findById(id).orElseThrow(() -> new RuntimeException("Employee not found"));

} catch (RuntimeException e) {

return "Error: " + e.getMessage();

}

}

🔹 **Issue?** This approach **mixes business logic with error handling**, making it less maintainable.

**2️⃣ Using @ExceptionHandler (Controller-Level)**

Spring allows handling exceptions at the **controller level** using @ExceptionHandler.

**Example: Handle a Custom Exception**

@ResponseStatus(HttpStatus.NOT\_FOUND) // Set HTTP status code

class EmployeeNotFoundException extends RuntimeException {

public EmployeeNotFoundException(String message) {

super(message);

}

}

@RestController

@RequestMapping("/employees")

public class EmployeeController {

private final EmployeeService employeeService;

public EmployeeController(EmployeeService employeeService) {

this.employeeService = employeeService;

}

@GetMapping("/{id}")

public Employee getEmployee(@PathVariable int id) {

return employeeService.findEmployee(id);

}

@ExceptionHandler(EmployeeNotFoundException.class)

public ResponseEntity<String> handleEmployeeNotFound(EmployeeNotFoundException ex) {

return new ResponseEntity<>(ex.getMessage(), HttpStatus.NOT\_FOUND);

}

}

🔹 **Pros?** Only affects this **specific controller**, making it useful for localized exception handling.

**3️⃣ Global Exception Handling Using @ControllerAdvice**

To handle exceptions **globally across the entire application**, use @ControllerAdvice.

@RestControllerAdvice

public class GlobalExceptionHandler {

@ExceptionHandler(EmployeeNotFoundException.class)

public ResponseEntity<String> handleEmployeeNotFound(EmployeeNotFoundException ex) {

return new ResponseEntity<>(ex.getMessage(), HttpStatus.NOT\_FOUND);

}

@ExceptionHandler(Exception.class)

public ResponseEntity<String> handleGenericException(Exception ex) {

return new ResponseEntity<>("Something went wrong: " + ex.getMessage(), HttpStatus.INTERNAL\_SERVER\_ERROR);

}

}

🔹 **Pros?** Ensures all controllers get consistent exception handling.

**4️⃣ Custom Exception Response Format**

To return **structured JSON responses**, create a custom error response.

**1️⃣ Create a Custom Error Response Class**

public class ErrorResponse {

private LocalDateTime timestamp;

private String message;

private String details;

public ErrorResponse(String message, String details) {

this.timestamp = LocalDateTime.now();

this.message = message;

this.details = details;

}

// Getters and Setters

}

**2️⃣ Modify @ControllerAdvice to Return JSON**

@RestControllerAdvice

public class GlobalExceptionHandler {

@ExceptionHandler(EmployeeNotFoundException.class)

public ResponseEntity<ErrorResponse> handleEmployeeNotFound(EmployeeNotFoundException ex, WebRequest request) {

ErrorResponse error = new ErrorResponse(ex.getMessage(), request.getDescription(false));

return new ResponseEntity<>(error, HttpStatus.NOT\_FOUND);

}

}

📌 Now, instead of a simple string, the API will return:

{

"timestamp": "2024-03-12T10:15:30",

"message": "Employee not found",

"details": "uri=/employees/10"

}

🔹 **Pros?** Improves API **readability and debugging**.

**5️⃣ Handling Validation Errors (Spring Boot + @Valid)**

For input validation errors in **Spring Boot REST APIs**, use @Valid.

**1️⃣ Add Validation in DTO**

import jakarta.validation.constraints.NotBlank;

public class EmployeeRequest {

@NotBlank(message = "Name is required")

private String name;

// Getters and Setters

}

**2️⃣ Handle Validation Errors**

@ExceptionHandler(MethodArgumentNotValidException.class)

public ResponseEntity<Map<String, String>> handleValidationExceptions(MethodArgumentNotValidException ex) {

Map<String, String> errors = new HashMap<>();

ex.getBindingResult().getFieldErrors().forEach(error -> errors.put(error.getField(), error.getDefaultMessage()));

return new ResponseEntity<>(errors, HttpStatus.BAD\_REQUEST);

}

🔹 Now, if validation fails, the response will be:

{

"name": "Name is required"

}

**6️⃣ Logging Exceptions (Using SLF4J/Logback)**

Instead of just returning an error, log it for debugging:

private static final Logger logger = LoggerFactory.getLogger(GlobalExceptionHandler.class);

@ExceptionHandler(Exception.class)

public ResponseEntity<String> handleGenericException(Exception ex) {

logger.error("Exception occurred: ", ex);

return new ResponseEntity<>("Internal Server Error", HttpStatus.INTERNAL\_SERVER\_ERROR);

}

🔹 **Pros?** Helps track errors in logs for debugging.

**🚀 Summary**

| **Approach** | **Scope** | **Use Case** |
| --- | --- | --- |
| **try-catch** | Method-Level | Small, localized exception handling |
| **@ExceptionHandler** | Controller-Level | Custom exception handling for a specific controller |
| **@ControllerAdvice** | Global | Application-wide error handling |
| **Custom Response (JSON)** | API | Structured error messages |
| **Validation Handling** | DTO Validation | Handling input validation errors |

Would you like to see an example with database transactions? 😊

Spring validation in java ?

A,

**Basic Questions**

1. **What is the Spring Framework?**
   * Answer: The Spring Framework is a comprehensive programming and configuration model for Java applications. It provides support for developing Java-based applications with features such as dependency injection, aspect-oriented programming, and more. It aims to simplify Java development by providing tools for managing objects and their dependencies, transaction management, and other critical tasks.
2. **What are the main features of the Spring Framework?**
   * Answer: Some of the main features include:
     + Dependency Injection (DI)
     + Aspect-Oriented Programming (AOP)
     + Transaction management
     + Spring MVC for web applications
     + Integration with other technologies (Hibernate, JPA, JMS, etc.)
3. **What is Dependency Injection (DI)?**
   * Answer: Dependency Injection is a design pattern that allows the creation of objects outside of a class and provides those objects to the class in some way. In Spring, DI is typically done through constructor injection, setter injection, or field injection.
4. **What is the Inversion of Control (IoC) container in Spring?**
   * Answer: The IoC container is responsible for managing the lifecycle and configuration of beans (objects) in a Spring application. It uses DI to wire the beans and manage their dependencies.
5. **What is a Bean in Spring?**
   * Answer: A bean is an object that is managed by the Spring IoC container. Beans are defined in the Spring context configuration and are created, initialized, and managed by the container.

**Intermediate Questions**

1. **What is Spring AOP?**
   * Answer: Aspect-Oriented Programming (AOP) is a programming paradigm that aims to increase modularity by separating cross-cutting concerns (e.g., logging, security, transactions) from the business logic. In Spring, AOP is used to add additional behavior to methods (like logging or transaction management) without modifying their code.
2. **What is Spring Bean Lifecycle?**
   * Answer: The Spring Bean lifecycle refers to the sequence of events that occur when a Spring container creates, manages, and destroys a bean. It includes the following stages:
     + Bean instantiation
     + Setting properties (DI)
     + Initialization (via @PostConstruct or custom init method)
     + Bean destruction (via @PreDestroy or custom destroy method)
3. **What are Spring Profiles?**
   * Answer: Spring Profiles allow you to define different configurations for different environments (e.g., development, production). You can use annotations like @Profile to specify which beans should be loaded for a given profile.
4. **What is Spring MVC?**
   * Answer: Spring MVC (Model-View-Controller) is a web framework within the Spring Framework used for building web applications. It is based on the MVC design pattern, where the Model represents the data, the View is responsible for rendering the user interface, and the Controller manages user input.
5. **What is the difference between @Controller and @RestController?**
   * Answer:
     + @Controller is used to define a Spring MVC controller for traditional web applications. It typically returns a view name.
     + @RestController is a convenience annotation that combines @Controller and @ResponseBody. It’s used for RESTful web services and automatically returns the response body (usually JSON or XML) instead of a view.

**Advanced Questions**

1. **What is the difference between @Component, @Repository, @Service, and @Controller annotations?**
   * Answer:
     + @Component: A generic stereotype for any Spring-managed bean.
     + @Repository: A specialization of @Component used for DAO (Data Access Object) classes, typically involved in data persistence.
     + @Service: A specialization of @Component used for service layer beans, which contain business logic.
     + @Controller: A specialization of @Component used in Spring MVC for handling web requests.
2. **What is the difference between @Autowired and @Inject?**
   * Answer:
     + @Autowired is a Spring-specific annotation that is used for automatic dependency injection.
     + @Inject is a Java standard annotation from JSR-330 (part of the Java Dependency Injection API) and works similarly to @Autowired.
3. **What is Spring Boot?**
   * Answer: Spring Boot is a framework built on top of the Spring Framework that simplifies the setup and configuration of Spring applications. It uses conventions over configuration, providing auto-configuration, embedded servers (like Tomcat), and easy-to-use setup for Spring-based applications.
4. **What is the difference between Spring and Spring Boot?**
   * Answer: Spring Boot simplifies the configuration and setup of Spring applications by providing built-in templates, embedded servers, and auto-configuration. Spring, on the other hand, requires more manual configuration and setup of the application context and infrastructure.
5. **What is a Spring Bean Scope?**
   * Answer: The scope of a Spring bean defines the lifespan and visibility of the bean in the Spring container. The common bean scopes are:
     + singleton: One instance of the bean is created for the entire application context.
     + prototype: A new instance of the bean is created each time it is requested.
     + request: A bean is created for each HTTP request (used in web applications).
     + session: A bean is created for each HTTP session.
     + application: A bean is created for the entire servlet context (used in web applications).
6. **What is a Spring Boot Starter?**
   * Answer: Spring Boot Starters are a set of pre-configured dependencies that simplify the setup of a Spring application. Examples include spring-boot-starter-web, spring-boot-starter-data-jpa, etc. They group common dependencies to make it easier to add functionality to the application.
7. **What is Spring Security and how does it work?**
   * Answer: Spring Security is a powerful and customizable authentication and authorization framework that provides security for Java applications. It handles authentication, authorization, and protects applications from common attacks like CSRF, XSS, etc.
8. **What are Spring Transactions and how are they managed?**
   * Answer: Spring provides an abstraction for managing transactions. Spring supports both programmatic and declarative transaction management. In declarative transaction management, annotations like @Transactional are used to manage transactions without writing boilerplate code.
9. **What is the use of @Transactional annotation?**
   * Answer: The @Transactional annotation is used to manage the transaction boundaries. It ensures that a method executes within the context of a transaction, and if any exception occurs, the transaction is rolled back. It can be applied to service layer methods to handle transaction management automatically.
10. **What is the purpose of ApplicationContext in Spring?**
    * Answer: ApplicationContext is the central interface to the Spring IoC container. It is responsible for instantiating, configuring, and managing beans. It also provides functionality like event propagation, internationalization, and AOP support.

These questions should help you prepare for a Spring Framework interview, covering key concepts and technical details. Be ready to explain your answers and provide examples from your experience.

Extra spring framework questions:

Bean factory vs application context ?

**ApplicationContext vs BeanFactory in Spring**

**🔹 Overview**

Both ApplicationContext and BeanFactory are **Spring containers** used for managing beans in a Spring application. However, they have some key differences in terms of features and usage.

**🔹 Key Differences**

| **Feature** | **BeanFactory** | **ApplicationContext** |
| --- | --- | --- |
| **Definition** | Core container for managing beans | Advanced container with additional features |
| **Lazy Initialization** | Creates beans **only when requested** | Creates beans **at startup** |
| **Event Handling** | No built-in event handling | Supports event propagation |
| **AOP & Transactions** | Not supported | Fully supported |
| **Internationalization (i18n)** | Not supported | Supports messages & i18n |
| **Application Layer** | Suitable for lightweight applications | Suitable for enterprise applications |

**🔹 Example 1: Using BeanFactory**

BeanFactory is the basic container in Spring and is created using XmlBeanFactory (deprecated) or DefaultListableBeanFactory.

import org.springframework.beans.factory.BeanFactory;

import org.springframework.beans.factory.xml.XmlBeanFactory;

import org.springframework.core.io.ClassPathResource;

public class BeanFactoryExample {

public static void main(String[] args) {

BeanFactory factory = new XmlBeanFactory(new ClassPathResource("beans.xml"));

// Fetching the bean

MyBean obj = (MyBean) factory.getBean("myBean");

obj.show();

}

}

**beans.xml**

<bean id="myBean" class="com.example.MyBean"/>

**🔹 Key Points:**  
✔ BeanFactory loads beans **only when needed** (lazy loading).  
✔ Lightweight but **lacks enterprise features**.

**🔹 Example 2: Using ApplicationContext**

ApplicationContext is an advanced container that **eagerly initializes** beans and provides extra features.

import org.springframework.context.ApplicationContext;

import org.springframework.context.support.ClassPathXmlApplicationContext;

public class ApplicationContextExample {

public static void main(String[] args) {

ApplicationContext context = new ClassPathXmlApplicationContext("beans.xml");

// Fetching the bean

MyBean obj = (MyBean) context.getBean("myBean");

obj.show();

}

}

**🔹 Key Points:**  
✔ **Eagerly initializes beans** at startup.  
✔ **Supports** events, AOP, internationalization, and transactions.

**🔹 When to Use What?**

✅ Use **BeanFactory** for **lightweight applications** where performance is critical.  
✅ Use **ApplicationContext** for **enterprise applications** with event handling, AOP, and internationalization.

Would you like a **real-world scenario comparison**? 😊

**Spring Bean Validation 🚀**

**🔹 What is Bean Validation?**

Spring Boot provides **built-in validation support** using **Jakarta Bean Validation API (JSR-380)**. It allows us to validate **fields in Java classes** using **annotations** like @NotNull, @Size, @Min, @Max, etc.

**🔹 Steps to Implement Bean Validation in Spring Boot**

**1️⃣ Add Dependency (If Needed)**

Spring Boot automatically includes spring-boot-starter-validation, but if missing, add it:

<dependency>

<groupId>org.springframework.boot</groupId>

<artifactId>spring-boot-starter-validation</artifactId>

</dependency>

**2️⃣ Define Entity with Validation Annotations**

Here’s an example of **a User entity with validation constraints**:

import jakarta.validation.constraints.\*;

public class User {

@NotNull(message = "ID cannot be null")

private Long id;

@NotBlank(message = "Name cannot be empty")

@Size(min = 3, max = 50, message = "Name must be between 3 and 50 characters")

private String name;

@Email(message = "Invalid email format")

private String email;

@Min(value = 18, message = "Age must be at least 18")

@Max(value = 60, message = "Age must be at most 60")

private int age;

// Getters and Setters

}

**3️⃣ Apply Validation in Controller**

Use @Valid in the request body to enable validation.

import org.springframework.web.bind.annotation.\*;

import jakarta.validation.Valid;

import org.springframework.http.ResponseEntity;

@RestController

@RequestMapping("/users")

public class UserController {

@PostMapping("/add")

public ResponseEntity<String> addUser(@Valid @RequestBody User user) {

return ResponseEntity.ok("User added successfully!");

}

}

**4️⃣ Handle Validation Errors Using @ExceptionHandler**

If validation fails, we can **handle errors gracefully** using @RestControllerAdvice.

import org.springframework.web.bind.MethodArgumentNotValidException;

import org.springframework.web.bind.annotation.\*;

import org.springframework.http.HttpStatus;

import org.springframework.http.ResponseEntity;

import java.util.HashMap;

import java.util.Map;

@RestControllerAdvice

public class GlobalExceptionHandler {

@ExceptionHandler(MethodArgumentNotValidException.class)

public ResponseEntity<Map<String, String>> handleValidationExceptions(MethodArgumentNotValidException ex) {

Map<String, String> errors = new HashMap<>();

ex.getBindingResult().getFieldErrors().forEach(error ->

errors.put(error.getField(), error.getDefaultMessage())

);

return new ResponseEntity<>(errors, HttpStatus.BAD\_REQUEST);

}

}

**🔹 Common Bean Validation Annotations**

| **Annotation** | **Description** |
| --- | --- |
| @NotNull | Field must not be null |
| @NotEmpty | Field must not be empty (works for strings & collections) |
| @NotBlank | Field must not be blank (removes spaces) |
| @Size(min, max) | Field length must be within range |
| @Email | Field must contain a valid email |
| @Pattern(regexp="regex") | Field must match regex pattern |
| @Min(value) | Field value must be greater than or equal to the specified number |
| @Max(value) | Field value must be less than or equal to the specified number |

Explain spring ioc in ?

**Spring IoC (Inversion of Control)** is a core concept where Spring manages object creation and dependency injection, removing the need for manual object management.

1. **IoC Container**: Manages beans (objects) and their lifecycle.
2. **Dependency Injection (DI)**: Injects dependencies into objects rather than the objects creating them.
3. **Bean**: An object that is managed by the Spring IoC container.
4. **ApplicationContext**: The central interface for Spring IoC, responsible for managing beans.
5. **Bean Configuration**: Beans can be configured in XML or Java-based configuration.
6. **@Autowired**: Automatically injects dependencies into beans.
7. **@Component**: Marks a class as a Spring-managed bean.
8. **@Bean**: Defines a bean in Java configuration.
9. **@Configuration**: Marks a class as a configuration class to define beans.
10. **Example**:

@Component

public class Car {

private Engine engine;

@Autowired

public Car(Engine engine) { this.engine = engine; }

}

@Component

public class Engine { }

@SpringBootApplication

public class Application {

public static void main(String[] args) {

ApplicationContext context = SpringApplication.run(Application.class, args);

Car car = context.getBean(Car.class);

}

}

In this example, the Car bean is automatically injected with an Engine bean by Spring IoC.

Ioc vs application context

A,

Here's a table summarizing the differences between **IoC (Inversion of Control)** and **ApplicationContext** in Spring:

| **Aspect** | **IoC (Inversion of Control)** | **ApplicationContext** |
| --- | --- | --- |
| **Definition** | A design principle where the framework manages object creation and dependencies. | A specific implementation of the IoC container in Spring. |
| **Purpose** | Decouples object creation and management from the application. | Manages beans and provides advanced features like lifecycle management. |
| **Type** | General design pattern used across frameworks. | Spring-specific container interface. |
| **Scope** | Focuses on dependency injection (DI) and controlling object creation. | Manages the full lifecycle and configuration of beans in Spring. |
| **Example** | Dependency Injection using **constructor** or **setter** injection. | AnnotationConfigApplicationContext, ClassPathXmlApplicationContext. |
| **Container** | Conceptual container for managing dependencies. | Actual container in Spring, implementing IoC with bean management. |
| **Advanced Features** | Does not provide advanced features directly. | Provides features like event handling, AOP, and internationalization. |
| **Implementation** | Implemented by frameworks like Spring, Google Guice, etc. | A specific implementation of IoC in the Spring Framework. |
| **Types** | Can be implemented using various patterns like **DI** or **Service Locator**. | Variants include AnnotationConfigApplicationContext and ClassPathXmlApplicationContext. |
| **Lifecycle Management** | IoC itself doesn’t manage the lifecycle; it's about dependency control. | Manages the lifecycle of beans (instantiation, initialization, destruction). |

This table clearly differentiates between the design principle of **IoC** and the **ApplicationContext**, which is the Spring-specific container that applies IoC for managing beans.

Bean vs component

A, In Spring, both **@Bean** and **@Component** are used to define beans, but they differ in usage and configuration.

1. **@Bean** is used in Java-based configuration to explicitly define a bean within a @Configuration class.
2. **@Component** is used to mark a class as a Spring-managed bean, typically in a component scan.
3. **@Bean** is method-level and returns an object that will be managed by the Spring container.
4. **@Component** is class-level and automatically detects and registers the class as a Spring bean.
5. **@Bean** allows for more fine-grained control over bean creation (e.g., scope, initialization).
6. **@Component** simplifies automatic component scanning and autowiring.
7. **@Bean** is commonly used for third-party libraries or when finer control is needed.
8. **@Component** is commonly used for Spring-managed classes within the application.
9. **@Bean** is used within a @Configuration class, while **@Component** requires component scanning (enabled by @ComponentScan).
10. **Example**:

**Using @Bean:**

@Configuration

public class AppConfig {

@Bean

public Car car() {

return new Car();

}

}

**Using @Component:**

@Component

public class Car { }

In this example, @Bean explicitly creates a bean in the configuration class, while @Component automatically registers the Car class as a Spring bean when component scanning is enabled.

Exaplain aop?

Certainly! Here's the table with a **code example** for **AOP (Aspect-Oriented Programming)** in Spring:

| **Aspect** | **Explanation** | **Example Code** |
| --- | --- | --- |
| **Definition** | AOP is a programming paradigm for separating cross-cutting concerns like logging or transactions from the core logic. | **Aspect**: Code that is modularized and applied across different methods (e.g., logging). |
| **Purpose** | Provides a way to modularize concerns (logging, transactions, etc.) without cluttering the main business logic. | Allows applying common concerns like logging, monitoring, or security to multiple parts of the application. |
| **Key Annotations** | - @Aspect: Marks a class as an aspect. - @Before: Executes before a method. - @After: Executes after a method. | java<br>@Aspect<br>public class LoggingAspect { <br>@Before("execution(\* com.example.service.\*.\*(..))")<br>public void logBefore() {...} <br>} |
| **Join Points** | Points in the program where the AOP advice can be applied (e.g., method executions). | **Example**: Method execution (e.g., every method in the com.example.service package). |
| **Pointcut** | An expression that selects the join points (where the advice is applied). | java<br>@Before("execution(\* com.example.service.\*.\*(..))")<br>public void logBefore(JoinPoint joinPoint) {...} |
| **Advice Types** | - **Before**: Executes before method execution. - **After**: Executes after method execution. - **Around**: Executes both before and after method execution. | **Before Example**: @Before("execution(\* com.example.service.\*.\*(..))") public void logBefore(JoinPoint joinPoint) {...} |
| **Implementation** | Spring AOP uses proxy-based AOP (either JDK dynamic proxies or CGLIB proxies). | **Proxy-based AOP**: Involves wrapping methods with a proxy to apply advice without modifying the original method. |
| **Example Scenario** | Use AOP to log method executions or handle transactions without modifying the core logic. | **Logging Aspect Example**: Logs method execution times for all methods in the service package. |
| **Example Code** | **Aspect Class**: Logs method execution time using **@Before** advice. | **Aspect Code**: |
|  | ```java | ```java |
|  | @Aspect | @Aspect |
|  | public class LoggingAspect { | public class LoggingAspect { |
|  | @Before("execution(\* com.example.service.*.*(..))") | @Before("execution(\* com.example.service.*.*(..))") |
|  | public void logBefore(JoinPoint joinPoint) { | public void logBefore(JoinPoint joinPoint) { |
|  | System.out.println("Executing method: " + joinPoint.getSignature().getName()); | System.out.println("Executing method: " + joinPoint.getSignature().getName()); |
|  | } | } |
|  | } | } |
|  | ``` | ``` |
| **Use Cases** | - Logging method calls. - Transaction management. - Security checks (e.g., authentication). | **Use Case Example**: Log execution time for all service methods or apply security checks to sensitive methods. |

**Explanation:**

* **Logging Aspect**:
  + **@Aspect**: Marks the class as an aspect.
  + **@Before**: The advice that runs before any method execution in the com.example.service package.
  + **JoinPoint**: Provides information about the method being executed (e.g., method name).

**How AOP Works:**

* **Join Point**: A point in the program (e.g., method execution) where you can apply your advice.
* **Pointcut**: A specification (like a regular expression) to match one or more join points.
* **Advice**: The action you want to perform (before, after, or around the join point).

This example uses AOP to log method executions across the service layer without adding the logging code directly to each service method.

How bean will be registered ?

In Spring, beans are registered in the **IoC (Inversion of Control) container** to manage their lifecycle and dependencies. The way beans are registered depends on how you define them: either through **Java Configuration**, **XML Configuration**, or **Component Scanning**.

Here’s how beans get registered in different scenarios:

**1. Using @Bean in Java Configuration**

When you define a bean using the @Bean annotation, it is registered explicitly in the Spring container. You use a **@Configuration** annotated class and define methods with the @Bean annotation that return the beans to be managed.

**Example:**

@Configuration

public class AppConfig {

@Bean

public Car car() {

return new Car();

}

}

In this case, car() will be registered as a Spring bean, and its instance will be managed by the Spring container.

**2. Using @Component and Component Scanning**

When you use the @Component annotation on a class, Spring automatically detects and registers the class as a bean during the component scanning phase (if component scanning is enabled).

**Example:**

@Component

public class Car {

private String model;

public String getModel() {

return model;

}

public void setModel(String model) {

this.model = model;

}

}

To enable component scanning, you can use @ComponentScan in the configuration class or let Spring Boot do it automatically in a Spring Boot application.

**Example (with @ComponentScan):**

@SpringBootApplication

@ComponentScan("com.example")

public class Application {

public static void main(String[] args) {

SpringApplication.run(Application.class, args);

}

}

Here, Spring will scan the package com.example for any classes annotated with @Component (or its specializations, like @Service, @Repository, @Controller, etc.) and register them as beans.

**3. Using @Configuration and @ComponentScan for Class-Level Scanning**

Spring can also detect and register beans using **class-level scanning** with @Configuration and @ComponentScan annotations.

**Example:**

@Configuration

@ComponentScan("com.example")

public class AppConfig {

// Beans will be automatically registered from the specified package

}

This tells Spring to scan the package com.example for classes annotated with @Component and register them as beans.

**4. Using XML Configuration (Traditional Spring Approach)**

In a traditional (non-Spring Boot) Spring application, beans can be defined and registered in an **XML configuration file**.

**Example (XML Configuration):**

<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.xsd">

<bean id="car" class="com.example.Car" />

</beans>

In this example, the Car class is explicitly defined as a bean with the id="car" in the Spring XML configuration.

**Summary of Bean Registration:**

1. **Using @Bean** in Java configuration: You explicitly define beans inside methods in a @Configuration class.
2. **Using @Component** with component scanning: The class is automatically registered as a bean if it's in a package that is scanned by Spring.
3. **Using XML Configuration**: Beans are manually defined in an XML configuration file.

The registration of beans depends on your chosen configuration style. Whether it's manual (@Bean, XML) or automatic (component scanning with @Component), Spring ensures that beans are registered in the container and managed throughout the application's lifecycle.

Spring framework modules ?  
a, The **Spring Framework** is a modular framework with several key modules:

1. **Core**: Provides IoC (Inversion of Control) and Dependency Injection (DI) for managing beans and their lifecycle.
2. **Beans**: Manages beans and their dependencies.
3. **Context**: Provides a framework for configuring and managing beans in the application context.
4. **Web**: Includes modules for building web applications, such as Spring MVC and Spring WebFlux.
5. **Data Access**: Supports JDBC, ORM (like Hibernate), and transaction management.
6. **Security**: Provides authentication, authorization, and security for applications.
7. **Caching**: Offers cache abstraction and integrates with caching providers.
8. **AOP**: Supports Aspect-Oriented Programming for separating cross-cutting concerns.
9. **Testing**: Provides tools for unit and integration testing.
10. **Spring Boot**: Simplifies Spring application configuration and deployment through autoconfiguration and embedded servers.

\*what is spring-boot?

Spring Boot is a Java framework that makes it easier to create and run Java applications. It simplifies the configuration and setup process, allowing developers to focus more on writing code for their applications.

\*Explain caching ?

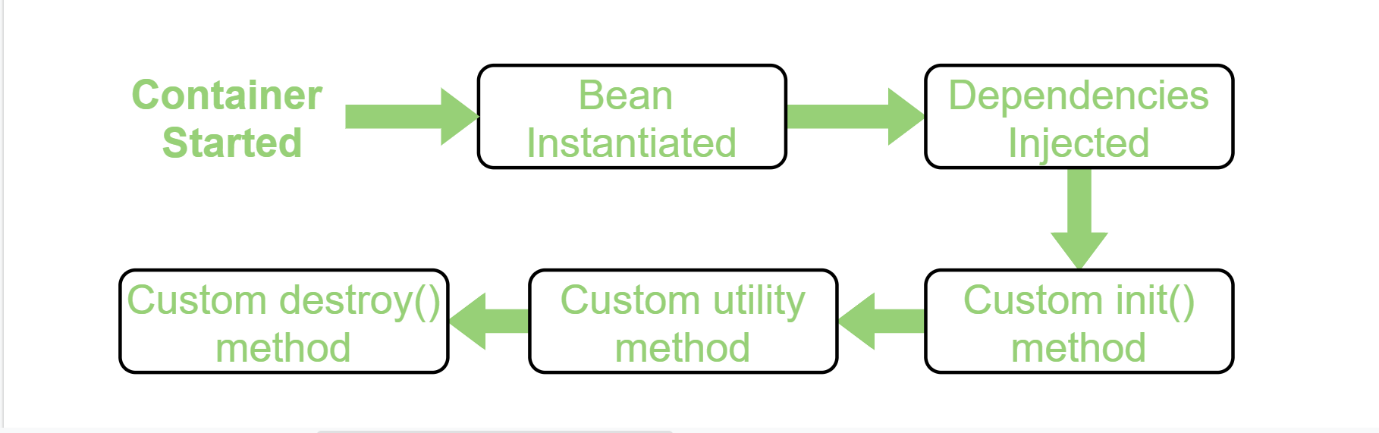
Caching in Spring is used to store frequently accessed data in memory to improve performance:

1. **Spring Cache** provides a simple abstraction for caching.
2. The @Cacheable annotation stores method results in the cache.
3. The @CacheEvict annotation removes items from the cache.
4. The @CachePut annotation updates cache entries without affecting method execution.
5. Spring supports caching providers like **EhCache**, **Redis**, and **Caffeine**.
6. Caching can be enabled with @EnableCaching in the application configuration.
7. **CacheManager** is responsible for managing caches.
8. Caching reduces database calls and speeds up data retrieval.
9. Caching strategies can be customized with annotations or configuration.
10. Spring Boot simplifies cache integration with auto-configuration.

\*what is bean?

\*what is beanlife cycle? The lifecycle of any object means when & how it is born, how it behaves throughout its life, and when & how it dies.

Bean life cycle is managed by the spring container. When we run the program then, first of all, the spring container gets started.



\*What is MVC architecture?

Model-View-Controller (MVC) is a design pattern used to separate concerns within an application, allowing for a more modular and maintainable codebase. It divides an application into three interconnected components:

1. **Model:** Represents the data and business logic of the application. It directly manages the data, logic, and rules of the application. The model is responsible for retrieving data from the database and performing operations on it.
2. **View:** Represents the UI (User Interface) of the application. It is responsible for displaying the data provided by the model in a specific format. The view interacts with the model to display data to the user and also receives user input.
3. **Controller:** Acts as an intermediary between the model and the view. It receives input from the user through the view, processes it (often by calling the appropriate method on the model), and then returns the output display to the view.

\*what are annotations?

Annotations are used to provide supplemental information about a program.

* Annotations start with ‘**@**’.
* Annotations do not change the action of a compiled program.
* Annotations help to associate *metadata* (information) to the program elements i.e. instance variables, constructors, methods, classes, etc.

A diagram of a company

AI-generated content may be incorrect.

There are broadly 5 categories of annotations as listed:

1. Marker Annotations
2. Single value Annotations
3. Full Annotations
4. Type Annotations
5. Repeating Annotation

\*Here’s a table summarizing the differences between **@RestController** and **@Controller** in Spring:

| **Aspect** | **@RestController** | **@Controller** |
| --- | --- | --- |
| **Purpose** | Used to create RESTful web services, returning data (e.g., JSON, XML). | Used for traditional web applications (usually with views like JSP, Thymeleaf). |
| **Response Type** | Returns data directly (usually as JSON or XML) via methods. | Typically returns a **view** name that will be resolved by a ViewResolver. |
| **Annotations Used** | Implicitly combines @Controller and @ResponseBody for data binding. | @Controller alone, and methods return views or model attributes. |
| **Usage** | Ideal for building REST APIs. | Ideal for MVC-based web applications where views are rendered. |
| **Return Type** | Returns data objects (e.g., JSON) that are automatically serialized. | Returns a **View** (e.g., JSP, Thymeleaf) or a redirect URL. |
| **Example Response** | @GetMapping("/users") public List<User> getUsers() {...} | @GetMapping("/home") public String showHomePage(Model model) {...} |
| **View Rendering** | Does not use ViewResolvers; data is sent directly in the response body. | Uses a ViewResolver to render a view (e.g., JSP, Thymeleaf). |
| **Usage in Spring Boot** | Often used in Spring Boot for building REST APIs with automatic JSON handling. | Used in Spring MVC for traditional server-side rendered pages. |
| **HTTP Response Format** | Automatically returns the response in JSON or XML format (based on the @ResponseBody logic). | The response is typically a rendered HTML view. |
| **Typical Scenarios** | RESTful services, mobile or frontend applications consuming data. | Traditional web applications where server renders a view with data. |

This table highlights the key differences between **@RestController** (used for REST APIs) and **@Controller** (used for MVC applications with view rendering).

\*What are types of annotations?

Annotations in Spring and Java are metadata that provide additional information about the code to the compiler and runtime. Here are some common annotations and their purposes:

**1. @Component**

* **Purpose:** Marks a Java class as a component or bean in the Spring context.
* **Usage:** It is a general-purpose stereotype annotation, often used to denote a class that can be automatically detected via classpath scanning.
* **Example:** @Component public class MyComponent { }

**2. @Service**

* **Purpose:** A specialized version of @Component, used to annotate service layer classes.
* **Usage:** Indicates that a class performs some business logic or service-related tasks.
* **Example:** @Service public class MyService { }

**3. @Repository**

* **Purpose:** Another specialization of @Component, used to annotate Data Access Object (DAO) classes.
* **Usage:** It provides additional functionalities like exception translation.
* **Example:** @Repository public class MyRepository { }

**4. @Controller**

* **Purpose:** A specialization of @Component, used to define a controller class in the Spring MVC framework.
* **Usage:** It is used to handle HTTP requests.
* **Example:** @Controller public class MyController { }

**5. @RestController**

* **Purpose:** Combines @Controller and @ResponseBody.
* **Usage:** Used to create RESTful web services by returning data instead of views.
* **Example:** @RestController public class MyRestController { }

**6. @Entity**

* **Purpose:** Specifies that a class is an entity and is mapped to a database table.
* **Usage:** Used in JPA (Java Persistence API) to define database entities.
* **Example:** @Entity public class MyEntity { @Id private Long id; }

**7. @Table**

* **Purpose:** Specifies the table name in the database that the entity is mapped to.
* **Usage:** Used in conjunction with @Entity to map an entity to a specific table.
* **Example:** @Entity @Table(name = "my\_table") public class MyEntity { }

**8. @Autowired**

* **Purpose:** Allows Spring to resolve and inject collaborating beans into your bean.
* **Usage:** Used for dependency injection.
* **Example:** @Autowired private MyService myService;

**9. @Qualifier**

* **Purpose:** Used along with @Autowired to avoid ambiguity when multiple beans of the same type exist.
* **Usage:** Specifies which bean to inject when there are multiple candidates.
* **Example:** @Autowired @Qualifier("myBean") private MyService myService;

**10. @RequestMapping**

* **Purpose:** Used to map web requests to specific handler classes or methods.
* **Usage:** Defines the URL pattern for a controller method.
* **Example:** @RequestMapping("/home") public String home() { return "home"; }

**11. @GetMapping, @PostMapping, @PutMapping, @DeleteMapping**

* **Purpose:** Specialized versions of @RequestMapping for specific HTTP methods.
* **Usage:** These annotations are shortcuts for @RequestMapping with method attribute.
* **Examples:**
  + @GetMapping("/items")
  + @PostMapping("/items")
  + @PutMapping("/items/{id}")
  + @DeleteMapping("/items/{id}")

**12. @Transactional**

* **Purpose:** Manages transaction boundaries.
* **Usage:** Used to ensure that a method or class has transactional semantics.
* **Example:** @Transactional public void performTransaction() { }

**13. @Configuration**

* **Purpose:** Indicates that a class is a source of bean definitions.
* **Usage:** Used to define beans and Spring configurations.
* **Example:** @Configuration public class MyConfig { }

**14. @Bean**

* **Purpose:** Indicates that a method produces a bean to be managed by Spring.
* **Usage:** Used within @Configuration classes to define beans.
* **Example:** @Bean public MyBean myBean() { return new MyBean(); }

**15. @Value**

* **Purpose:** Injects values from a property file into a Spring bean.
* **Usage:** Used to read values from configuration properties.
* **Example:** @Value("${my.property}") private String myProperty;

**16. @Scope**

* **Purpose:** Specifies the scope of a bean.
* **Usage:** Defines how a bean is created and managed.
* **Example:** @Scope("singleton") public class MyBean { }

These annotations are fundamental in Spring-based applications for defining and managing the various components and behaviors.

\*what are annotations needed in department model to provide string methods,gettersetters,allconstructors,noconstructors with detailed explanation?

 **@Entity**

* Marks this class as a JPA entity, meaning it represents a table in a relational database.
* The Department class will be mapped to a database table, with each instance of the class representing a row in that table.

 **@Data**

* A Lombok annotation that automatically generates boilerplate code like getters, setters, toString(), equals(), and hashCode() methods.
* This simplifies your code by removing the need to manually write these methods.

 **@AllArgsConstructor**

* Another Lombok annotation that generates a constructor with parameters for all fields in the class.
* Useful when you want to create an instance of the Department class and set all of its fields in one step.

 **@NoArgsConstructor**

* Lombok annotation that generates a no-argument constructor.
* This is required by JPA, which needs a default constructor to create an instance of the entity when fetching data from the database.

 **@Builder**

* Lombok annotation that provides a builder pattern for your class.
* This allows you to create instances of the Department class in a more readable and flexible way, especially useful when the class has many fields.

**@Id and @GeneratedValue(strategy = GenerationType.IDENTITY)**:

* @Id: Marks the field as the primary key.
* @GeneratedValue(strategy = GenerationType.IDENTITY): Specifies that the primary key should be generated automatically by the database.

### \* what is dependency injection? Key Concepts of Dependency Injection

1. **Dependency**: A dependency is any object that another object requires to function. For example, if a Car class needs an Engine to operate, the Engine is a dependency of the Car.

### Injection: Instead of the Car class creating its own Engine object, an external source (often a DI framework) provides the Engine to the Car. This "injecting" of dependencies can happen through constructors, setters, or directly into fields. Types of Dependency Injection

1. **Constructor Injection**: Dependencies are provided through a class's constructor.

java

Copy code

public class Car {

private Engine engine;

public Car(Engine engine) {

this.engine = engine;

}

public void start() {

engine.run();

}

}

Here, the Engine dependency is injected into the Car class via its constructor.

1. **Setter Injection**: Dependencies are provided through setter methods.

java

Copy code

public class Car {

private Engine engine;

public void setEngine(Engine engine) {

this.engine = engine;

}

public void start() {

engine.run();

}

}

The Engine is injected into the Car class using the setEngine method.

1. **Field Injection**: Dependencies are injected directly into fields. In frameworks like Spring, this is often done using annotations.

java

Copy code

public class Car {

@Autowired

private Engine engine;

public void start() {

engine.run();

}

}

In this example, the Engine dependency is injected directly into the engine field by the DI container.

### \*  What does the @SpringBootApplication annotation do internally?

The **@SpringBootApplication**annotation combines three annotations. Those three annotations are: **@Configuration, @EnableAutoConfiguration,**and **@ComponentScan**.

* **@AutoConfiguration**: This annotation automatically configuring beans in the class path and automatically scans the dependencies according to the application need.
* **@ComponentScan**: This annotation scans the components (@Component, @Service, etc.) in the package of annotated class and its sub-packages.
* **@Configuration:**This annotation configures the beans and packages in the class path.

@SpringBootApplication automatically configures the application based on the dependencies added during project creation and bootstraps the application by using run() method inside the main class of an application.

*@SpringBootApplication = @Configuration +*

*@EnableAutoConfiguration + @ComponentScan*

### *\** What is Spring Initializr?

**Spring Initializer**is a tool that helps us to create skeleton of spring boot project or project structure by providing a maven or gradle file to build the application. It set up the framework from scratch.

### \* ****How does a spring application get started?****

A Spring application gets started by calling the **main()**method with **@SpringBootApplication**annotation in the **SpringApplication**class. This method takes a SpringApplicationBuilder object as a parameter, which is used to configure the application.

### \*  What are the Spring Boot Starter Dependencies?

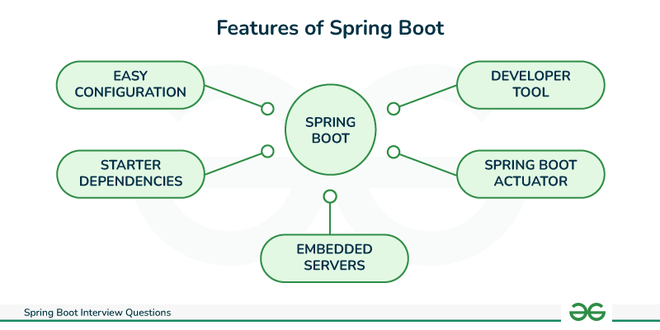
Spring Boot provides many starter dependencies. Some of them which are used the most in the Spring Boot application are listed below:

* Data JPA starter
* Web starter
* Security starter
* Test Starter
* Thymeleaf starter

### What are the Features of Spring Boot?

There are many useful features of Spring Boot. Some of them are mentioned below:

* **Auto-configuration –**Spring Boot automatically configures dependencies by using **@EnableAutoconfiguration**annotation and reduces boilerplate code.
* **Spring Boot Starter POM**– These Starter POMs are pre-configured dependencies for functions like database, security, maven configuration etc.
* **Spring Boot CLI (Command Line Interface)**– This command line tool is generally for managing dependencies, creating projects and running the applications.
* **Actuator –**Spring Boot Actuator provides health check, metrics and monitors the endpoints of the application. It also simplifies the troubleshooting management.
* **Embedded Servers –**Spring Boot contains embedded servers like Tomcat and Jetty for quick application run. No need of external servers.



### \* Describe the flow of HTTPS requests through the Spring Boot application.

The flow of HTTPS requests through a Spring Boot application is as follows:

A diagram of a spring boot flow

AI-generated content may be incorrect.

* First client makes an **HTTP request**( **GET, POST, PUT, DELETE**) to the browser.
* After that the request will go to the controller, where all the requests will be mapped and handled.
* After this in Service layer, all the **business logic**will be performed. It performs the business logic on the data that is mapped to **JPA (Java Persistence API)**using model classes.
* In repository layer, all the **CRUD**operations are being done for the **REST APIs**.
* A **JSP page**is returned to the end users if no errors are there.

### \* Explain @RestController annotation in Spring Boot.

**@RestController**annotation is like a shortcut to building RESTful services. It combines two annotations:

* **@Controller**: Marks the class as a request handler in the Spring MVC framework.
* **@ResponseBody**: Tells Spring to convert method return values (objects, data) directly into HTTP responses instead of rendering views.

### \* Difference between @Controller and @RestController

| **Features** | **@Controller** | **@RestController** |
| --- | --- | --- |
| **Usage** | It marks a class as a controller class. | It combines two annotations i.e. @Controller and @ResponseBody. |

### \* What are the differences between @SpringBootApplication and @EnableAutoConfiguration annotation?

| **Features** | **@SpringBootApplication** | **@EnableAutoConfiguration** |
| --- | --- | --- |
| **When to use** | When we want to use auto-configuration | When we want to customize auto-configuration |
| **Entry point** | Typically used on the main class of a Spring Boot application, serving as the entry point. | Can be used on any configuration class or in conjunction with @SpringBootApplication. |
| **Component Scanning** | Includes **@ComponentScan**annotation to enable component scanning. | Does not perform component scanning by itself. |
| **Example** | @SpringBootApplication public class MyApplication { public static void main(String[] args) { SpringApplication.run(MyApplication.class, args); } } |  |

### \* What are Profiles in Spring?

**Spring Profiles**are like different scenarios for the application depending on the environment.

* You define sets of configurations (like database URLs) for different situations (development, testing, production).
* Use the **@Profile**annotation to clarify which config belongs to where.
* Activate profiles with **environment variables**or **command-line**options

### \* Mention the differences between WAR and embedded containers.

| **Feature** | **WAR** | **Embedded containers** |
| --- | --- | --- |
| **Packaging** | Contains all of the files needed to deploy a web application to a web server. | It is a web application server included in the same JAR file as the application code. |

### \*  What is Spring Boot Actuator?

**Spring Boot Actuator**is a component of the Spring Boot framework that provides production-ready operational monitoring and management capabilities. We can manage and monitor your Spring Boot application while it is running.

### \* What is the purpose of using @ComponentScan in the class files?

**@ComponentScan**annotation is used to tell Spring to scan a package and automatically detect Spring components, configurations, and services to configure. The @ComponentScan annotation can be used in the following ways:

* **Without arguments**
* **With basePackageClasses**
* **With basePackages**

### \* How to get the list of all the beans in your Spring boot application?

* Using the **ApplicationContext**object in Spring Boot, we can retrieve a list of all the beans in our application.
* The ApplicationContext is responsible for managing the beans and their dependencies.

### \* What is an IOC container?

An **IoC (Inversion of Control)**Container in Spring Boot is essentially a central manager for the application objects that controls the creation, configuration, and management of dependency injection of objects (often referred to as beans), also referred to as a DI (Dependency Injection) container.

### \* What is the difference between Constructor and Setter Injection?

| **Features** | **Constructor Injection** | **Setter Injection** |
| --- | --- | --- |
| **Dependency** | Dependencies are provided through constructor parameters. | Dependencies are set through setter methods after object creation. |
| **Immutability** | Promotes immutability as dependencies are set at creation. | Dependencies can be changed dynamically after object creation. |

### \* Explain Spring Data and What is Data JPA?

**Spring Data**is a powerful framework that can be used to develop data-oriented applications. It aims to simplify the development of data-centric applications by offering abstractions, utilities, and integration with various data sources.

* **Spring Data JPA:**This project provides support for accessing data from relational databases using JPA.

### \* Explain Spring MVC

**MVC**stands for **Model, View,**and **Controller. Spring MVC**is a web MVC framework built on top of the Spring Framework. It provides a comprehensive programming model for building web applications.

### \* What is Bean Wiring?

**Bean wiring**is a mechanism in Spring that is used to manage the dependencies between beans. It allows Spring to inject collaborating beans into each other. There are two types of Bean Wiring:

* Autowiring
* Manual wiring

### \* What is Spring Bean?

An object that is managed by the Spring IoC container is referred to as a spring bean. A Spring bean can be any Java object.

Interview questions by backend developer?

Here are the answers to your questions related to REST APIs:

**Q1. What is idempotency in REST API?**

**Idempotency** in the context of REST APIs means that making the same request multiple times will always produce the same result and will not cause additional side effects. Specifically, this applies to HTTP methods like PUT and DELETE, where the state of the server remains the same regardless of how many times the request is repeated.

Example:

* **GET** requests are always idempotent because querying the same resource multiple times returns the same response.
* **PUT** requests are idempotent, as updating a resource with the same data doesn't change the result.
* **POST** requests, in contrast, are generally **not idempotent**, as submitting the same data multiple times may create multiple resources.

**Q2. What are the best practices for designing RESTful APIs?**

Here are some best practices for designing RESTful APIs:

1. **Use HTTP Methods Correctly**:
   * **GET** for fetching resources.
   * **POST** for creating resources.
   * **PUT** for updating resources.
   * **DELETE** for deleting resources.
   * **PATCH** for partial updates.
2. **Use Proper HTTP Status Codes**:
   * 200 OK for successful requests.
   * 201 Created for successful resource creation.
   * 400 Bad Request for invalid input.
   * 404 Not Found for non-existent resources.
   * 500 Internal Server Error for server issues.
3. **Resource Naming Convention**:
   * Use plural nouns for resource names (e.g., /users, /orders).
   * Avoid using verbs in URLs (e.g., /getUsers).
4. **Statelessness**: Ensure each API request is independent, and the server should not store any client context between requests.
5. **Use Query Parameters for Filtering**:
   * For example: /users?age=25&city=NewYork.
6. **Pagination**: For large datasets, paginate the results using query parameters (page, size).
7. **Versioning**: Use versioning in the URL or headers, such as /v1/users or /api/v1/users.
8. **Error Handling**: Return meaningful error messages and use appropriate HTTP status codes.
9. **Use HTTPS**: Always secure APIs with SSL/TLS encryption.

**Q3. What is the difference between SOAP and REST?**

**SOAP (Simple Object Access Protocol)** and **REST (Representational State Transfer)** are two different approaches for building web services:

1. **Protocol vs. Architectural Style**:
   * **SOAP** is a protocol that has a strict set of rules to follow.
   * **REST** is an architectural style, which provides guidelines but not a strict set of rules.
2. **Message Format**:
   * **SOAP** uses XML for message format.
   * **REST** can use various formats like JSON, XML, or plain text.
3. **Communication**:
   * **SOAP** relies on protocols like HTTP, SMTP, and others.
   * **REST** relies on HTTP methods such as GET, POST, PUT, and DELETE.
4. **Performance**:
   * **SOAP** tends to be more heavy-weight due to its XML messaging.
   * **REST** is lightweight, especially when using JSON.
5. **Security**:
   * **SOAP** has built-in security (WS-Security) for secure messaging.
   * **REST** relies on the security provided by HTTP, such as HTTPS and OAuth.
6. **Statefulness**:
   * **SOAP** can be stateful or stateless.
   * **REST** is typically stateless.

**Q4. How will you secure your APIs?**

There are several approaches to securing REST APIs:

1. **Authentication**:
   * Use OAuth 2.0 for token-based authentication.
   * Use **Basic Authentication** or **Bearer Tokens**.
   * Implement **JWT (JSON Web Tokens)** for stateless authentication.
2. **Authorization**:
   * Use roles and permissions to ensure users have access to specific resources.
   * Implement **Role-Based Access Control (RBAC)**.
3. **Data Encryption**:
   * Always use **HTTPS** (SSL/TLS) to encrypt data in transit.
   * Ensure sensitive data is encrypted both at rest and in transit.
4. **Input Validation**:
   * Validate all input data to prevent injection attacks (e.g., SQL Injection, XML Injection).
5. **Rate Limiting**:
   * Implement rate limiting to prevent abuse of your APIs.
6. **Cross-Origin Resource Sharing (CORS)**:
   * Implement proper CORS policies to restrict which domains can access your API.
7. **Logging and Monitoring**:
   * Log API access, and monitor requests to detect suspicious activities.

**Q5. What is the difference between PUT and POST methods in REST API?**

* **PUT**:
  + **Idempotent**: Making the same PUT request multiple times results in the same outcome (e.g., updating a resource).
  + Used to **update** a resource or create a resource at a specific URL.
  + Example: PUT /users/123 (update user with ID 123).
* **POST**:
  + **Non-idempotent**: Making the same POST request multiple times can result in multiple resources being created.
  + Used to **create** a new resource.
  + Example: POST /users (create a new user).

**Q6. What is HATEOAS in RESTful API?**

**HATEOAS** (Hypermedia as the Engine of Application State) is a constraint of REST that allows clients to navigate the API dynamically by following links provided in the responses. Essentially, it means that the client doesn't need to know all the available operations beforehand. The API response includes links to related resources, helping the client interact with the API without prior knowledge of the full API structure.

Example response with HATEOAS:

{

"userId": 123,

"name": "John Doe",

"\_links": {

"self": { "href": "/users/123" },

"orders": { "href": "/users/123/orders" },

"update": { "href": "/users/123" }

}

}

**Q7. What are the common security vulnerabilities in RESTful APIs?**

Common security vulnerabilities in RESTful APIs include:

1. **Injection Attacks**: SQL Injection, XML Injection, etc.
2. **Broken Authentication**: Poor or incorrect authentication mechanisms.
3. **Sensitive Data Exposure**: Failure to encrypt sensitive data during transmission (e.g., passwords, tokens).
4. **Cross-Site Scripting (XSS)**: Injecting malicious scripts into responses.
5. **Cross-Site Request Forgery (CSRF)**: Exploiting an authenticated user's session to perform unauthorized actions.
6. **Insecure Direct Object References (IDOR)**: Exposing internal objects (e.g., database records) to unauthorized access.
7. **Excessive Data Exposure**: Over-sharing sensitive data in API responses.

**Q8. What is CSP Header?**

**CSP** (Content Security Policy) is a security header that helps to prevent a variety of attacks, such as Cross-Site Scripting (XSS), by specifying which sources the browser should allow content to be loaded from. The Content-Security-Policy header can be used to control which domains are allowed to load resources like scripts, styles, images, etc.

Example:

Content-Security-Policy: default-src 'self'; script-src 'self' https://apis.example.com;

This ensures that only resources from the same domain or https://apis.example.com can be loaded.

**Q9. How does versioning work in REST APIs?**

**Versioning** in REST APIs helps manage changes over time without breaking existing client applications. Common approaches include:

1. **URI Versioning**: Including the version in the URL path.
   * Example: /v1/users, /v2/users.
2. **Query Parameter Versioning**: Passing the version as a query parameter.
   * Example: /users?version=1.
3. **Header Versioning**: Using custom HTTP headers to specify the API version.
   * Example: X-API-Version: 1.
4. **Content Negotiation**: Using the Accept header to specify the desired version.
   * Example: Accept: application/vnd.myapi.v1+json.

**Q10. What is HSTS?**

**HSTS** (HTTP Strict Transport Security) is a security header used to instruct browsers to only communicate with the server over HTTPS. Once the browser receives the HSTS header, it will refuse to connect to the server using HTTP, even if the user tries to visit the HTTP version of the site.

Example:

Strict-Transport-Security: max-age=31536000; includeSubDomains

This tells browsers to enforce HTTPS for the domain for one year (max-age=31536000 seconds) and its subdomains.

These are the detailed answers to your REST API questions! Let me know if you'd like more details or clarification on any topic!

Here are answers to the most common Spring Framework questions:

**Q1. What is Spring Framework?**

The **Spring Framework** is a comprehensive programming and configuration model for Java-based enterprise applications. It is known for its modular architecture and focuses on providing infrastructure support for developing Java applications. It simplifies Java development and promotes good design practices, such as Dependency Injection (DI) and aspect-oriented programming (AOP).

**Q2. What is DI or Dependency Injection?**

**Dependency Injection (DI)** is a design pattern in which an object receives its dependencies (other objects it needs) rather than creating them itself. This promotes loose coupling and easier testing by decoupling the objects. In Spring, DI can be done using constructor injection, setter injection, or field injection.

**Q3. What is IOC or Inversion of Control?**

**Inversion of Control (IoC)** refers to the principle where the control of objects or portions of a program is transferred to a container or framework. In Spring, this is implemented through the **ApplicationContext**, which manages the lifecycle of beans (objects) and injects their dependencies as needed.

**Q4. What are different modules in Spring Framework?**

Spring consists of several modules, including:

* **Core Container Modules**: Core, Beans, Context, and Expression Language.
* **Data Access and Integration**: JDBC, ORM, JMS, Transactions.
* **Web Modules**: Web, Web MVC, WebSocket, WebFlux.
* **Security**: Spring Security for authentication and authorization.
* **Testing**: Spring Test for unit and integration testing.

**Q5. Explain the bean scopes supported by Spring.**

Spring supports the following bean scopes:

* **Singleton**: One shared instance per Spring container.
* **Prototype**: A new instance is created every time a bean is requested.
* **Request**: A new instance is created for each HTTP request.
* **Session**: A new instance is created for each HTTP session.
* **Global Session**: A new instance for a global HTTP session (used in portlets).

**Q6. Explain Spring Bean Life Cycle.**

The lifecycle of a Spring bean is managed by the Spring container. The steps involved are:

1. **Instantiation**: The bean is created.
2. **Populating Properties**: Dependencies are injected.
3. **Bean Name Awareness**: If the bean implements BeanNameAware, Spring calls setBeanName().
4. **BeanFactory Awareness**: If the bean implements BeanFactoryAware, Spring calls setBeanFactory().
5. **ApplicationContext Awareness**: If the bean implements ApplicationContextAware, Spring calls setApplicationContext().
6. **Pre-Initialization**: A bean post processor can be applied before initialization.
7. **Initialization**: If the bean implements InitializingBean or has an init-method, it will be called.
8. **Post-Initialization**: A bean post processor can be applied after initialization.
9. **Destruction**: If the bean implements DisposableBean or has a destroy-method, it will be called upon container destruction.

**Q7. Explain different types of Autowiring.**

Spring provides several ways to autowire dependencies:

1. **Autowire by Type**: Spring automatically injects a bean by matching the data type.
   * Example: @Autowired on a field or setter method.
2. **Autowire by Name**: Spring injects a bean by matching the name of the property with the bean's name.
   * Example: @Autowired with @Qualifier to specify the name of the bean.
3. **Autowire by Constructor**: Spring injects dependencies via constructor parameters.
   * Example: @Autowired on a constructor.
4. **Autowire by Primary**: If multiple candidates exist, Spring will use the bean marked as @Primary.

**Q8. Difference between Tight Coupling and Loose Coupling?**

* **Tight Coupling**: When two classes are directly dependent on each other, making it difficult to change one class without affecting the other.
* **Loose Coupling**: When classes are independent, with minimal dependencies between them. This allows for easier maintenance, testing, and scalability.

**Q9. Difference between a Singleton and a Prototype Bean?**

* **Singleton**: A single instance of the bean is shared across the entire Spring container.
* **Prototype**: A new instance of the bean is created every time it is requested from the container.

**Q10. Which is the default scope of bean in Spring? And are they synchronized?**

The default scope of a Spring bean is **Singleton**. This means there is only one instance of the bean in the Spring container. Singleton beans are **not synchronized** by default. If thread safety is needed, synchronization can be implemented.

**Q11. What are different types of Bean Injection?**

* **Constructor Injection**: Dependencies are passed through the constructor.
* **Setter Injection**: Dependencies are set via setter methods.
* **Field Injection**: Dependencies are injected directly into the fields.

**Q12. Differences between Spring and Spring Boot?**

* **Spring**: A framework for building Java-based applications. It requires configuration of application context, XML configurations, etc.
* **Spring Boot**: A tool to simplify Spring application setup and development. It provides embedded servers (e.g., Tomcat), automatic configuration, and simplified dependency management. It requires minimal configuration.

**Q13. Why do we use application.properties?**

application.properties (or application.yml) is used to configure Spring Boot applications. It holds configuration settings such as database connection details, server port, logging, etc.

**Q14. What is Spring Boot Actuator?**

Spring Boot Actuator provides production-ready features to monitor and manage Spring Boot applications, such as health checks, metrics, and application environment details.

**Q15. What are the actuator-provided endpoints used for monitoring the Spring boot application?**

Commonly used Spring Boot Actuator endpoints include:

* /actuator/health – Health check status of the application.
* /actuator/metrics – Metrics related to the application’s performance.
* /actuator/env – Application environment details.
* /actuator/info – General application information.

**Q16. How to enable Actuator in Spring Boot application?**

To enable Actuator, add the Spring Boot Actuator dependency to your pom.xml (for Maven) or build.gradle (for Gradle) file:

<dependency>

<groupId>org.springframework.boot</groupId>

<artifactId>spring-boot-starter-actuator</artifactId>

</dependency>

**Q17. List the ways to change the port of the embedded Tomcat server in Spring Boot?**

You can change the port of the embedded Tomcat server in Spring Boot using:

1. **application.properties**:
2. server.port=8081
3. **application.yml**:
4. server:
5. port: 8081
6. **Command-line argument**:
7. java -jar app.jar --server.port=8081

**Q18. List some commonly used dependency starters for Spring Boot?**

Common Spring Boot starters include:

* spring-boot-starter-web – For web applications.
* spring-boot-starter-data-jpa – For JPA-based database interaction.
* spring-boot-starter-thymeleaf – For Thymeleaf templating.
* spring-boot-starter-actuator – For application monitoring.

**Q19. Explain Commonly used Spring Boot Starters?**

Starters are pre-configured dependencies for specific tasks. Some commonly used Spring Boot starters are:

* spring-boot-starter-web: For developing web applications with RESTful APIs.
* spring-boot-starter-data-jpa: For integrating JPA/Hibernate with Spring Boot.
* spring-boot-starter-thymeleaf: For web applications using the Thymeleaf templating engine.
* spring-boot-starter-security: For adding Spring Security to the application.

**Q20. Spring Configuration, XML vs Annotation?**

* **XML-based configuration**: Configurations are declared in applicationContext.xml. It is verbose and requires manual wiring.
* **Annotation-based configuration**: Uses annotations such as @Configuration, @Bean, @Autowired, @Component to define beans and their dependencies in a much more concise and readable manner.

Feel free to ask about any specific question or more detailed explanations on any of these topics!

Sure! Here's the continuation of the answers:

**Q21. Application Context in Spring Boot?**

The **ApplicationContext** in Spring Boot is a central interface to the Spring IoC container. It provides methods to configure, load, and retrieve beans. It is responsible for managing the lifecycle of beans and handling dependency injection. There are different types of ApplicationContext implementations, such as ClassPathXmlApplicationContext and AnnotationConfigApplicationContext.

**Q22. What is the Role of SpringBootApplication annotation?**

The @SpringBootApplication annotation is a convenience annotation that combines three annotations:

1. @Configuration: Marks the class as a source of bean definitions for the application context.
2. @EnableAutoConfiguration: Tells Spring Boot to automatically configure the application based on the dependencies in the classpath.
3. @ComponentScan: Tells Spring to scan for other components, configurations, and services in the specified package.

It is typically placed on the main application class to bootstrap a Spring Boot application.

**Q23. What is the purpose of the @Qualifier annotation in Spring?**

The @Qualifier annotation is used in conjunction with @Autowired to resolve ambiguity when multiple beans of the same type are present in the Spring container. It allows you to specify the exact bean to be injected by name or ID.

Example:

@Autowired

@Qualifier("myBean")

private MyBean myBean;

**Q24. Why do we use @ComponentScan in class files?**

@ComponentScan is used to specify the packages that Spring should scan for annotated components (e.g., @Component, @Service, @Repository, @Controller). By default, @ComponentScan scans the package where the configuration class is located, but you can specify additional packages if needed.

Example:

@ComponentScan(basePackages = "com.example")

**Q25. What is the difference between Bean Factory and ApplicationContext?**

* **BeanFactory**: The basic container in Spring that provides essential features, such as dependency injection. It loads beans lazily, meaning beans are created when requested.
* **ApplicationContext**: An extension of BeanFactory that adds more enterprise-level features, such as event propagation, declarative mechanisms, and internationalization (i18n). It eagerly loads singleton beans during the initialization of the container.

In general, ApplicationContext is more commonly used in Spring applications.

**Q26. What do you mean by Spring Batch?**

**Spring Batch** is a lightweight, comprehensive batch processing framework designed for handling large volumes of data. It provides reusable and customizable components for reading, processing, and writing data. Spring Batch supports features like transaction management, chunk processing, and parallel processing.

**Q27. What are use cases of Spring Batch?**

Spring Batch is typically used in scenarios that involve processing large amounts of data, such as:

* Reading and writing data to databases.
* Batch processing for ETL (Extract, Transform, Load) tasks.
* Data migration between systems.
* Generating reports or exporting large datasets.

**Q28. Explain Transactional Annotation in Java8?**

The @Transactional annotation in Spring is used to manage transactions at the method or class level. It ensures that a method or group of methods will execute within a single transaction, and if an exception occurs, the transaction will be rolled back.

Example:

@Transactional

public void processOrder() {

// Business logic

}

It can be applied to both classes and methods.

**Q29. Explain Spring Transaction Propagation Levels?**

Spring provides several **transaction propagation levels** to manage how transactions behave when invoked from within another transaction:

1. **REQUIRED**: If there’s an existing transaction, it will be used; otherwise, a new transaction will be created.
2. **REQUIRES\_NEW**: Always creates a new transaction, suspending any existing transaction.
3. **SUPPORTS**: If there’s an existing transaction, it will be used; otherwise, no transaction will be started.
4. **NOT\_SUPPORTED**: If there’s an existing transaction, it will be suspended; no transaction will be started.
5. **MANDATORY**: A transaction must exist; if not, an exception is thrown.
6. **NEVER**: A transaction should never exist; if one exists, an exception is thrown.
7. **NESTED**: Executes within a nested transaction if there’s an existing one; otherwise, a new transaction will be created.

**Q30. List all Spring annotations?**

Some commonly used Spring annotations include:

* @Component: Marks a class as a Spring-managed bean.
* @Service: Marks a service class, a specialization of @Component.
* @Repository: Marks a DAO class, a specialization of @Component.
* @Controller: Marks a controller class in Spring MVC.
* @RestController: A convenience annotation for REST controllers.
* @Autowired: Injects dependencies.
* @Qualifier: Specifies which bean to inject when multiple beans of the same type are available.
* @RequestMapping, @GetMapping, @PostMapping: For mapping HTTP requests in Spring MVC.
* @Transactional: Marks a method or class for transaction management.
* @Value: Injects values from properties files.
* @Bean: Declares a bean definition in Java configuration.

**Q31. What are some of the important Spring annotations?**

Some of the important Spring annotations include:

* @Autowired: Used for dependency injection.
* @Component, @Service, @Repository, @Controller: Used to define beans in the Spring container.
* @RequestMapping, @GetMapping, @PostMapping: Used in Spring MVC for mapping HTTP requests.
* @Transactional: Defines transactional boundaries for methods or classes.
* @SpringBootApplication: Combines several annotations to enable Spring Boot application features.
* @EnableAutoConfiguration: Used for automatic configuration in Spring Boot.
* @Configuration: Marks a class as a source of bean definitions.

**Q32. Difference between @RequestParam and @PathVariable in Spring MVC?**

* @RequestParam: Used to extract query parameters from the request URL or form data.

Example:

@GetMapping("/user")

public String getUser(@RequestParam String id) {

return "User ID: " + id;

}

* @PathVariable: Used to extract variables from the URI path.

Example:

@GetMapping("/user/{id}")

public String getUser(@PathVariable String id) {

return "User ID: " + id;

}

**Q33. What is the difference between RequestMapping and GetMapping?**

* @RequestMapping: A generic annotation used to map any HTTP request (GET, POST, PUT, DELETE, etc.) to a method.

Example:

@RequestMapping("/user")

public String getUser() { return "User"; }

* @GetMapping: A specialized version of @RequestMapping that handles only HTTP GET requests.

Example:

@GetMapping("/user")

public String getUser() { return "User"; }

**Q34. What is ResponseEntity in Spring Boot?**

ResponseEntity is a wrapper around the response body and allows customization of the response's HTTP status, headers, and body. It is used to return complex responses from REST controllers.

Example:

@GetMapping("/user")

public ResponseEntity<User> getUser() {

User user = userService.getUser();

return new ResponseEntity<>(user, HttpStatus.OK);

}

Let me know if you'd like further explanations on any of these topics or others!

Sure! Here's the continuation, answering the next set of questions:

**Q35. Which version of Spring Boot are you using?**

The version of Spring Boot can be checked in the pom.xml file in the <parent> tag, or you can execute the following command:

mvn dependency:tree | grep spring-boot

This will show the Spring Boot version being used in your project.

**Q36. In Spring Boot, what is the use of dev tools?**

Spring Boot DevTools is a set of tools that enhance the development experience. It provides features such as:

* **Automatic restarts**: The application restarts automatically when files in the classpath change.
* **LiveReload**: Automatically refreshes the browser when the code is changed.
* **Enhanced logging**: Provides detailed logging for debugging.

You can add it as a dependency in pom.xml:

<dependency>

<groupId>org.springframework.boot</groupId>

<artifactId>spring-boot-devtools</artifactId>

<scope>runtime</scope>

</dependency>

**Q37. True or False? Every Spring Boot application is a web application running within an embedded Apache Tomcat.**

**False**. While Spring Boot can use an embedded Apache Tomcat server for web applications, it can also run standalone applications (without a web server), for example, console-based applications or batch jobs.

**Q38. Custom exception handling in Spring Boot?**

In Spring Boot, custom exception handling is typically done using @ControllerAdvice and @ExceptionHandler annotations to handle exceptions globally and send custom error responses.

Example:

@ControllerAdvice

public class GlobalExceptionHandler {

@ExceptionHandler(ResourceNotFoundException.class)

public ResponseEntity<Object> handleNotFound(ResourceNotFoundException ex) {

return new ResponseEntity<>(new ErrorResponse("Not Found", ex.getMessage()), HttpStatus.NOT\_FOUND);

}

}

**Q39. Write code to configure Spring Boot’s exception handling so that our back-end application will respond with an error message in the following format?**

Example response format for errors:

{

"status": "error",

"message": "Resource not found",

"timestamp": "2022-05-01T14:30:00"

}

@ControllerAdvice

public class GlobalExceptionHandler {

@ExceptionHandler(ResourceNotFoundException.class)

public ResponseEntity<ErrorResponse> handleResourceNotFound(ResourceNotFoundException ex) {

ErrorResponse error = new ErrorResponse("error", ex.getMessage(), LocalDateTime.now());

return new ResponseEntity<>(error, HttpStatus.NOT\_FOUND);

}

}

**Q40. What are JPA entity graphs?**

JPA entity graphs provide a way to specify which associations (such as @ManyToOne, @OneToMany, etc.) should be eagerly loaded or lazily loaded during a query, providing more fine-grained control over the fetching strategy.

Example:

@NamedEntityGraph(name = "User.profile", attributeNodes = @NamedAttributeNode("profile"))

You can use it in a repository query:

@EntityGraph(value = "User.profile", type = EntityGraphType.FETCH)

List<User> findAll();

**Q41. Why is Spring preferred over frameworks or core benefits of Spring Framework?**

Spring provides several advantages over other frameworks:

* **Comprehensive**: It offers everything you need to build applications, from dependency injection to transaction management.
* **Loose coupling**: With Dependency Injection (DI) and Inversion of Control (IoC), Spring reduces tight coupling.
* **Flexibility**: It supports multiple data access strategies (JDBC, JPA, Hibernate) and various web frameworks.
* **Testability**: Spring provides built-in support for writing unit and integration tests.

**Q42. What are different modules in Spring framework?**

Some of the core modules in the Spring framework include:

* **Spring Core**: The core container that provides essential features like DI and IoC.
* **Spring AOP**: Aspect-Oriented Programming module to separate cross-cutting concerns.
* **Spring Data Access**: Handles data access with JDBC, JPA, and ORM.
* **Spring MVC**: A web module for building web applications.
* **Spring Security**: Security features such as authentication and authorization.
* **Spring Batch**: Batch processing framework.
* **Spring Integration**: Integration for messaging and enterprise applications.

**Q43. What do you understand by Dependency Injection?**

Dependency Injection (DI) is a design pattern in which an object's dependencies are provided (injected) from the outside rather than the object creating them itself. This reduces the dependency between classes, making them easier to test and maintain.

Example:

public class Car {

private Engine engine;

@Autowired

public Car(Engine engine) {

this.engine = engine;

}

}

**Q44. How Can We Inject Beans in Spring?**

Spring provides three common methods to inject beans:

1. **Constructor Injection**:
2. @Autowired
3. public Car(Engine engine) {
4. this.engine = engine;
5. }
6. **Setter Injection**:
7. @Autowired
8. public void setEngine(Engine engine) {
9. this.engine = engine;
10. }
11. **Field Injection**:
12. @Autowired
13. private Engine engine;

**Q45. Which Is the Best Way of Injecting Beans?**

The best method for bean injection is **constructor injection** because:

* It makes the bean immutable.
* It is easier to write unit tests.
* It ensures that required dependencies are provided at the time of bean creation.

**Q46. Explain the bean scopes supported by Spring?**

Spring supports the following bean scopes:

1. **Singleton**: One instance of the bean is created and shared across the entire Spring container (default).
2. **Prototype**: A new instance of the bean is created each time it is requested.
3. **Request**: A new bean instance is created for each HTTP request (available in web applications).
4. **Session**: A new bean instance is created for each HTTP session (available in web applications).
5. **Application**: A single bean instance is created for each Spring ServletContext (available in web applications).
6. **Websocket**: A new bean is created for each WebSocket session.

**Q47. How to Define the Scope of a Bean?**

The scope of a bean is defined using the @Scope annotation.

Example:

@Component

@Scope("prototype")

public class Car {

// Car properties

}

**Q48. Explain Spring Bean Life Cycle?**

Spring Bean Lifecycle includes the following steps:

1. **Instantiation**: A bean is instantiated.
2. **Populate properties**: Spring injects dependencies into the bean (via DI).
3. **Pre-initialization**: BeanPostProcessors are called before initialization.
4. **Initialization**: The bean is initialized (e.g., @PostConstruct).
5. **Post-initialization**: BeanPostProcessors are called after initialization.
6. **Destruction**: The bean is destroyed (e.g., @PreDestroy).

**Q49. Which DI would you suggest Constructor-based or Setter-based DI?**

Constructor-based DI is preferred because:

* It makes the bean immutable.
* It ensures that the bean has all required dependencies at the time of creation.
* It is easier to validate and maintain.

**Q50. What are different types of auto wiring?**

Spring supports several types of autowiring:

1. **By Type** (@Autowired on the field or constructor):
2. @Autowired
3. private Engine engine;
4. **By Name** (via @Qualifier):
5. @Autowired
6. @Qualifier("engine1")
7. private Engine engine;
8. **By Constructor**: Spring automatically injects dependencies via the constructor.
9. **By Autowiring XML Configuration**: The autowire attribute in the XML configuration file.

**Q51. What is the difference between Tight Coupling and Loose Coupling?**

* **Tight Coupling**: Classes are highly dependent on each other, and changes in one class may affect others. It makes testing and maintaining code difficult.
* **Loose Coupling**: Classes are independent of each other, and changes in one class have minimal impact on others. It improves code maintainability and testability.

**Q52. What is the difference between a singleton and a prototype bean?**

* **Singleton Bean**: A single instance of the bean is created and shared across the entire Spring container.
* **Prototype Bean**: A new instance of the bean is created each time it is requested.

**Q53. Which is the default scope of a bean in Spring? Are they synchronized?**

The default scope is **Singleton**, meaning one instance is created per Spring container. **Singleton beans are not synchronized**, so care must be taken when sharing state between multiple threads.

**Q54. Explain the concept of Autowiring.**

Autowiring is the process where Spring automatically injects the dependent beans into a class. Spring supports autowiring by type, name, and constructor.

**Q55. Spring vs Spring MVC vs Spring Boot**

* **Spring**: The core framework that provides DI, IoC, transaction management, etc.
* **Spring MVC**: A part of Spring used for building web applications using the Model-View-Controller pattern.
* **Spring Boot**: A tool to quickly create stand-alone Spring applications, typically web applications, with minimal configuration.

**Q56. Why do we use application.properties?**

application.properties is used in Spring Boot to define configuration values for the application. It can define settings like database URLs, server ports, logging configurations, etc.

**Q57. What are the actuator-provided endpoints used for monitoring the Spring boot application?**

Spring Boot Actuator provides several useful endpoints for monitoring, such as:

* /actuator/health: Provides health status of the application.
* /actuator/metrics: Provides various application metrics.
* /actuator/info: Displays arbitrary application info.
* /actuator/env: Displays the environment properties.

Let me know if you'd like me to continue or need more information!

Certainly! Here's the continuation until question 100:

**Q58. List the ways to change the port of the embedded Tomcat server in Spring Boot?**

You can change the port of the embedded Tomcat server by modifying the application.properties or application.yml:

1. **application.properties**:
2. server.port=8081
3. **application.yml**:
4. server:
5. port: 8081

Alternatively, you can set the port programmatically by using:

@SpringBootApplication

public class Application {

public static void main(String[] args) {

SpringApplication app = new SpringApplication(Application.class);

app.setDefaultProperties(Collections.singletonMap("server.port", "8081"));

app.run(args);

}

}

**Q59. List some commonly used dependency starters for Spring Boot?**

Some commonly used Spring Boot dependency starters are:

* spring-boot-starter-web for building web applications.
* spring-boot-starter-data-jpa for integrating with JPA.
* spring-boot-starter-thymeleaf for using Thymeleaf templates.
* spring-boot-starter-security for adding Spring Security.
* spring-boot-starter-actuator for application monitoring and management.
* spring-boot-starter-test for unit and integration testing.

**Q60. What is the difference between the Configuration types XML and Annotation?**

* **XML Configuration**: Uses beans.xml files to configure the Spring context and define beans. Example:
* <bean id="car" class="com.example.Car" />
* **Annotation-based Configuration**: Uses annotations like @Configuration, @Bean, and @Component to define beans and configuration. Example:
* @Configuration
* public class AppConfig {
* @Bean
* public Car car() {
* return new Car();
* }
* }

Annotation-based configuration is preferred for simplicity and flexibility, reducing the need for verbose XML.

**Q61. What is Application Context and Explain the process of creating an ApplicationContext in Spring?**

The **ApplicationContext** is the central interface to the Spring container. It provides configuration information and manages the lifecycle of beans.

To create an ApplicationContext:

1. **XML-based configuration**:
2. ApplicationContext context = new ClassPathXmlApplicationContext("beans.xml");
3. **Annotation-based configuration**:
4. ApplicationContext context = new AnnotationConfigApplicationContext(AppConfig.class);

The ApplicationContext automatically loads and manages beans.

**Q62. What is the difference between Bean Factory and ApplicationContext?**

* **BeanFactory**: The simplest container in Spring. It is used for non-web, lightweight applications. It only loads beans when they are requested.
* **ApplicationContext**: Extends BeanFactory and adds additional features, including event propagation, internationalization, and AOP support. It is generally used in more complex applications, including web applications.

**Q63. How do you implement asynchronous processing in a Spring Boot application?**

You can use @Async annotation in Spring to handle asynchronous processing.

1. **Enable asynchronous processing**:
2. @Configuration
3. @EnableAsync
4. public class AppConfig {
5. }
6. **Use @Async annotation**:
7. @Service
8. public class MyService {
9. @Async
10. public void doSomething() {
11. // Some long-running task
12. }
13. }

This will run the doSomething() method asynchronously in a separate thread.

**Q64. Explain the usage of the @Async annotation in Spring?**

The @Async annotation allows methods to execute asynchronously in a separate thread. It can be used on methods of service classes that take a long time to execute and allows non-blocking execution.

Example:

@Async

public CompletableFuture<String> processAsyncTask() {

return CompletableFuture.completedFuture("Task Completed");

}

**Q65. Explain the purpose of Spring WebFlux?**

Spring WebFlux is a reactive programming framework that is part of Spring 5. It is designed to create non-blocking, event-driven applications. It supports reactive streams and provides better scalability for high-concurrency environments.

WebFlux can run on reactive runtimes such as **Netty** or **Undertow**, unlike traditional Spring MVC which is based on servlet-based containers.

**Q66. What do you mean by Spring Batch?**

Spring Batch is a lightweight framework designed to handle large volumes of data, providing features like chunk-based processing, transaction management, and task scheduling. It is ideal for batch jobs such as ETL (Extract, Transform, Load) processes.

**Q67. What is the main use of the Spring Batch framework?**

Spring Batch is used for creating and running batch processing tasks. It is commonly used in scenarios like:

* ETL processes
* Large data migration tasks
* Log processing
* File processing

It supports features like transaction management, chunk-oriented processing, and scheduling.

**Q68. What is the role of @SpringBootApplication?**

The @SpringBootApplication annotation is a convenience annotation that combines:

* @Configuration: Marks the class as a source of bean definitions.
* @EnableAutoConfiguration: Enables Spring Boot's auto-configuration mechanism.
* @ComponentScan: Automatically scans and registers beans in the application context.

It is typically used on the main application class to configure Spring Boot applications.

**Q69. What are some of the important Spring annotations?**

Important Spring annotations include:

* @Component: Marks a class as a Spring bean.
* @Autowired: Used for autowiring dependencies.
* @Configuration: Marks a class as a configuration class.
* @Bean: Defines a Spring bean in a configuration class.
* @RequestMapping: Maps HTTP requests to handler methods.
* @Service, @Repository, @Controller: Specialized forms of @Component for different layers.

**Q70. Difference between @RequestParam and @PathVariable in Spring MVC?**

* **@RequestParam**: Used to extract query parameters from the request URL. Example:
* @GetMapping("/greet")
* public String greet(@RequestParam String name) {
* return "Hello, " + name;
* }
* **@PathVariable**: Used to extract values from the URI path. Example:
* @GetMapping("/greet/{name}")
* public String greet(@PathVariable String name) {
* return "Hello, " + name;
* }

**Q71. What is the difference between RequestMapping and GetMapping?**

* **@RequestMapping**: A general-purpose annotation for mapping HTTP requests to handler methods. It can be used for any HTTP method (GET, POST, etc.).

Example:

@RequestMapping(value = "/greet", method = RequestMethod.GET)

public String greet() {

return "Hello!";

}

* **@GetMapping**: A specialized version of @RequestMapping used specifically for GET requests.

Example:

@GetMapping("/greet")

public String greet() {

return "Hello!";

}

**Q72. Why do we use @componentScan in class files?**

The @ComponentScan annotation tells Spring to scan the specified package(s) for components (@Component, @Service, @Repository, @Controller, etc.) and register them as beans in the Spring application context.

**Q73. Differentiate @Component, @Repository, @Service, and @Controller?**

* @Component: A general-purpose annotation to mark a Spring bean.
* @Repository: A specialization of @Component, used to mark DAO classes.
* @Service: A specialization of @Component, used for service layer beans.
* @Controller: A specialization of @Component, used for Spring MVC controller beans.

All of these annotations are used to automatically detect and register beans during classpath scanning.

**Q74. What is the purpose of the @Qualifier annotation in Spring?**

The @Qualifier annotation is used to specify which bean to inject when multiple beans of the same type are available. It helps to avoid ambiguity.

Example:

@Autowired

@Qualifier("carEngine")

private Engine engine;

**Q75. Explain the usage of the @Transactional annotation in Spring?**

The @Transactional annotation is used to manage transactions in Spring. It ensures that a method runs within a transaction context. If any exception occurs during the method execution, the transaction is rolled back.

Example:

@Transactional

public void transferMoney(Account fromAccount, Account toAccount, double amount) {

fromAccount.withdraw(amount);

toAccount.deposit(amount);

}

**Q76. How does the @Transactional annotation work internally?**

Internally, the @Transactional annotation works by creating a proxy around the target method. The proxy manages the transaction and commits or rolls it back depending on the outcome. By default, transactions are committed if the method executes successfully, and rolled back if a runtime exception occurs.

**Q77. Explain the usage of the @ExceptionHandler annotation in Spring MVC?**

The @ExceptionHandler annotation is used to handle exceptions in Spring MVC controllers. It allows you to define methods that handle specific exceptions and send custom responses to the client.

Example:

@ExceptionHandler(ResourceNotFoundException.class)

public ResponseEntity<String> handleNotFound(ResourceNotFoundException ex) {

return new ResponseEntity<>(ex.getMessage(), HttpStatus.NOT\_FOUND);

}

I hope this helps! Let me know if you need further details or additional questions answered.

Sure! Continuing with the next set of questions and answers:

**Q78. What is the difference between RequestMapping and GetMapping?**

* **@RequestMapping**: It is a general-purpose annotation that can map HTTP requests of any method type (GET, POST, DELETE, PUT, etc.). You can specify the method type using the method attribute.

Example:

@RequestMapping(value = "/greet", method = RequestMethod.GET)

public String greet() {

return "Hello!";

}

* **@GetMapping**: It is a shortcut for @RequestMapping(method = RequestMethod.GET) and is used exclusively for GET requests.

Example:

@GetMapping("/greet")

public String greet() {

return "Hello!";

}

**Q79. What are the common Spring Boot test annotations?**

Some common Spring Boot test annotations are:

* **@SpringBootTest**: Used to load the full application context for integration testing.
* **@MockBean**: Used to mock beans in the application context for testing.
* **@WebMvcTest**: Used for testing Spring MVC controllers.
* **@DataJpaTest**: Used for testing JPA components like repositories.
* **@Test**: Standard JUnit annotation for defining test methods.

**Q80. When and where do you use @Transactional in testing?**

In testing, @Transactional is often used to ensure that database operations are rolled back after the test method completes. This prevents changes to the database from affecting other tests.

Example:

@Transactional

public void testDatabaseOperation() {

// Test code

}

**Q81. What are the differences between @MockBean and @Mock annotations?**

* **@MockBean**: A Spring Boot test annotation used to mock beans in the Spring ApplicationContext. It is commonly used in integration tests to mock the behavior of a service or repository.

Example:

@MockBean

private MyService myService;

* **@Mock**: A JUnit or Mockito annotation used to create a mock object of a class. It does not integrate with the Spring context but is used for unit tests.

Example:

@Mock

private MyService myService;

**Q82. Why do we do @Autowired when we can use the NEW operator?**

Using @Autowired allows Spring to manage the object lifecycle and inject dependencies. When you use the new operator, you create the object manually, which bypasses Spring's dependency injection and management features, such as AOP (Aspect-Oriented Programming) and transaction management.

**Q83. What is Spring Boot Actuator, and how does it help in monitoring and managing applications?**

Spring Boot Actuator provides production-ready features to help monitor and manage Spring Boot applications. It exposes endpoints for health checks, metrics, environment properties, application information, and more. Some common endpoints include /actuator/health, /actuator/metrics, /actuator/env.

**Q84. How can you customize Spring Boot Actuator endpoints?**

You can customize actuator endpoints by configuring properties in the application.properties or application.yml file or through code.

For example, to enable or disable specific endpoints:

management.endpoints.enabled-by-default=false

management.endpoints.web.exposure.include=health,info

You can also create custom endpoints by implementing @Endpoint and @ReadOperation, @WriteOperation, etc.

**Q85. How does Spring Boot support data access?**

Spring Boot supports data access using multiple technologies:

1. **JDBC**: With Spring JDBC, you can work directly with relational databases using JdbcTemplate.
2. **JPA (Java Persistence API)**: Spring Data JPA integrates with Hibernate and provides a repository pattern for object-relational mapping (ORM).
3. **MyBatis**: Spring Boot can integrate with MyBatis, a persistence framework that provides SQL-based access to databases.
4. **MongoDB**: Spring Data MongoDB provides access to MongoDB with a repository pattern.

**Q86. How do you handle exceptions in a Spring Boot RESTful API?**

You can handle exceptions globally using @ControllerAdvice or locally using @ExceptionHandler.

Example of @ControllerAdvice for global exception handling:

@ControllerAdvice

public class GlobalExceptionHandler {

@ExceptionHandler(ResourceNotFoundException.class)

public ResponseEntity<String> handleResourceNotFound(ResourceNotFoundException ex) {

return new ResponseEntity<>(ex.getMessage(), HttpStatus.NOT\_FOUND);

}

}

**Q87. What are the annotations you use in your Spring MVC applications?**

Common annotations used in Spring MVC include:

* **@Controller**: Defines a controller class.
* **@RequestMapping**: Maps HTTP requests to methods in a controller.
* **@GetMapping**, **@PostMapping**, **@PutMapping**, **@DeleteMapping**: Specialized versions of @RequestMapping for HTTP methods.
* **@RequestParam**: Binds query parameters to method parameters.
* **@PathVariable**: Binds URL path variables to method parameters.
* **@ResponseBody**: Indicates that the return value should be written directly to the HTTP response body.

**Q88. Do you know the use of @ModelAttribute in Spring MVC?**

@ModelAttribute is used to bind a method parameter or method return value to a named model attribute, which is then accessible in the view. It can also be used to pre-populate a model before a controller method is executed.

Example:

@ModelAttribute

public void addAttributes(Model model) {

model.addAttribute("message", "Hello World!");

}

**Q89. What is AOP (Aspect-Oriented Programming)?**

AOP is a programming paradigm that aims to increase modularity by separating cross-cutting concerns (e.g., logging, transaction management, security) from the business logic. In Spring, AOP is used to define aspects, join points, and advice.

Example:

@Aspect

@Component

public class LoggingAspect {

@Before("execution(\* com.example.service.\*.\*(..))")

public void logBeforeMethod(JoinPoint joinPoint) {

System.out.println("Before executing: " + joinPoint.getSignature().getName());

}

}

**Q90. Explain advice in AOP?**

In AOP, **advice** is the action taken by an aspect at a particular join point. There are several types of advice:

* **Before**: Runs before the method execution.
* **After**: Runs after the method execution, regardless of the outcome.
* **AfterReturning**: Runs after the method execution if it returns successfully.
* **AfterThrowing**: Runs if the method throws an exception.
* **Around**: Surrounds the method execution, allowing you to modify the method's input/output or prevent it from running.

**Q91. What are the join points and pointcuts in AOP?**

* **Join Point**: A point in the execution of the program, such as method execution or field access, where you can insert advice.
* **Pointcut**: A predicate that matches join points. It defines where the advice should be applied.

Example:

@Pointcut("execution(\* com.example.service.\*.\*(..))")

public void serviceMethods() {}

**Q92. How to call a stored procedure from Java using Spring Framework?**

To call a stored procedure in Spring, you can use JdbcTemplate or SimpleJdbcCall. Here's an example using SimpleJdbcCall:

SimpleJdbcCall jdbcCall = new SimpleJdbcCall(jdbcTemplate).withProcedureName("my\_procedure");

Map<String, Object> result = jdbcCall.execute(parameters);

**Q93. How is an event handled in Spring?**

In Spring, events are handled by publishing and listening to them. You can use ApplicationEventPublisher to publish events and @EventListener to handle them.

Example:

@Component

public class MyEventListener {

@EventListener

public void handleCustomEvent(CustomEvent event) {

System.out.println("Received event: " + event.getMessage());

}

}

**Q94. What is the JDBC template, and how to use it in Spring?**

The JdbcTemplate is a Spring class that simplifies database interaction by eliminating the need for boilerplate code such as connection handling and exception management.

Example usage:

@Autowired

private JdbcTemplate jdbcTemplate;

public List<String> getNames() {

String sql = "SELECT name FROM users";

return jdbcTemplate.queryForList(sql, String.class);

}

**Q95. How do you deploy a Spring Boot application?**

Spring Boot applications can be deployed in various ways:

1. **Standalone JAR**: Package the application as a JAR file using mvn clean package and run it with java -jar.
2. **War Deployment**: Package the application as a WAR file and deploy it to a servlet container like Tomcat.
3. **Docker**: Create a Docker image and deploy the Spring Boot application in a container.

This completes the continuation up to question 95. Let me know if you'd like further continuation!

Sure! Here’s the continuation from question 96 onward:

**Q96. What is the difference between JDBC and Spring JDBC?**

* **JDBC** (Java Database Connectivity) is a low-level API for interacting with databases, requiring explicit connection handling, error handling, and result set processing.
* **Spring JDBC** provides a higher-level abstraction over JDBC, simplifying database interactions by handling connections, exceptions, and result set parsing using classes like JdbcTemplate. It also offers mechanisms like NamedParameterJdbcTemplate and SimpleJdbcCall to simplify queries and stored procedure calls.

**Q97. Why do we need the spring-boot-maven-plugin?**

The spring-boot-maven-plugin allows for easy packaging of Spring Boot applications as executable JAR or WAR files. It also facilitates running the application directly from Maven using the command mvn spring-boot:run. The plugin automates the packaging, provides support for embedded servers (like Tomcat or Jetty), and allows for easy dependency management.

**Q98. What is the difference between JPA and Hibernate?**

* **JPA** (Java Persistence API) is a specification that defines how Java objects can be persisted in relational databases, without providing the actual implementation. It specifies the object-relational mapping (ORM) model.
* **Hibernate** is a concrete implementation of JPA. It is a framework that provides the actual logic for ORM and is widely used in Java applications for database interaction.

In short, JPA is an API, while Hibernate is a tool that implements the JPA specification.

**Q99. Differentiate between findById() and getOne() in Spring Data JPA.**

* **findById()**: Returns an Optional<T>. It performs an immediate database query and returns a result wrapped in an Optional to handle the case when no entity is found.

Example:

Optional<User> user = userRepository.findById(1L);

* **getOne()**: Returns a reference to the entity. It doesn't perform a query immediately but rather fetches the entity lazily (when the reference is accessed). It may throw an exception if the entity is not found.

Example:

User user = userRepository.getOne(1L);

**Q100. What are the latest specifications supported by Spring?**

Spring supports many Java and framework specifications, and here are some of the latest ones:

* **Spring Framework 5** supports Java 8+ features like Lambdas, Streams, and functional programming.
* **Spring 5** also supports reactive programming through **Spring WebFlux**.
* **Spring Boot 2.5+** supports the latest Java versions (Java 16, 17).
* **Spring Data** now supports the latest JPA and MongoDB features.
* **Spring Security** supports OAuth2.0, JWT authentication, and reactive security.

This completes the continuation of the questions. Let me know if you need further elaboration on any topic or more questions!

Sure, let’s continue from where we left off.

**Q101. How to create a Stateful bean in Spring?**

A stateful bean in Spring refers to a bean that holds state between multiple method invocations. The typical scope for such beans is **@Scope("session")**, as it allows the bean to maintain its state across requests within a session.

Example:

@Component

@Scope("session")

public class StatefulBean {

private String data;

public String getData() {

return data;

}

public void setData(String data) {

this.data = data;

}

}

**Q102. How do you define profiles in Spring Boot?**

Spring Boot profiles are used to define configurations for different environments (e.g., dev, prod). You can define profiles using the @Profile annotation or in application.properties or application.yml.

Example:

@Profile("dev")

@Component

public class DevBean {

// Bean configuration for dev profile

}

In application.properties, you specify the active profile:

spring.profiles.active=dev

**Q103. What is the use of Profiles in Spring Boot?**

Profiles in Spring Boot allow you to configure different beans and properties for different environments (e.g., development, testing, production). This helps to maintain separate configurations for each environment, allowing you to switch environments without changing code.

For example, you might have a dev profile for local development, and a prod profile for production.

**Q104. How can we use profiles to configure environment-specific configuration with Spring Boot application?**

You can create separate property files for each profile in Spring Boot:

* application-dev.properties
* application-prod.properties

Then, specify the active profile in the main application.properties:

spring.profiles.active=dev

Each property file can contain environment-specific values, and Spring Boot will automatically load the correct file based on the active profile.

**Q105. How do you write unit tests for Spring Boot applications?**

You can write unit tests for Spring Boot applications using JUnit and Spring’s testing support. For example:

@RunWith(SpringRunner.class)

@SpringBootTest

public class MyServiceTest {

@Autowired

private MyService myService;

@Test

public void testServiceMethod() {

String result = myService.method();

assertEquals("expected result", result);

}

}

**Q106. How do you perform integration testing in Spring Boot?**

Integration testing in Spring Boot can be done using @SpringBootTest. It loads the full application context and allows you to test the entire application stack, including web layers, services, and repositories.

Example:

@RunWith(SpringRunner.class)

@SpringBootTest

public class MyIntegrationTest {

@Autowired

private MyController myController;

@Test

public void testEndpoint() {

ResponseEntity<String> response = myController.getResponse();

assertEquals(HttpStatus.OK, response.getStatusCode());

}

}

**Q107. What are some best practices for optimizing Spring Boot applications?**

Some best practices for optimizing Spring Boot applications include:

* Use **lazy initialization** for beans that are not required on startup.
* **Profile-specific properties**: Define properties specific to environments to optimize resource usage.
* Use **asynchronous processing** for long-running tasks.
* Enable **caching** for frequent database queries.
* Optimize **database connections** by using connection pooling.
* **Monitor performance** with Spring Boot Actuator and use its endpoints for health checks and metrics.

**Q108. What is the role of DispatcherServlet in Spring MVC?**

The DispatcherServlet is the central component in Spring MVC. It receives all incoming HTTP requests and delegates them to appropriate handlers (controller methods). It acts as a front controller, which provides a clean separation between the user interface and business logic layers.

**Q109. What is Transaction Management in Spring? Explain the different types of Transaction Management.**

Transaction management in Spring provides a consistent abstraction for managing transactions, independent of the underlying transaction system (JDBC, JPA, JMS, etc.). The two main types are:

* **Programmatic Transaction Management**: Managed using PlatformTransactionManager and manual transaction management in code.
* **Declarative Transaction Management**: Managed using annotations like @Transactional or via XML configuration.

Spring simplifies transaction management by using **AOP** (Aspect-Oriented Programming) for declarative transactions.

**Q110. How do you handle database transactions in a Spring Boot application?**

You can handle database transactions in Spring Boot using the @Transactional annotation. It ensures that the methods inside a class are executed within a single transaction. For example:

@Service

public class MyService {

@Transactional

public void performTransaction() {

// Code to interact with the database

}

}

The transaction will commit if the method completes successfully and will roll back if an exception occurs.

**Q111. How to monitor and manage a Spring Boot application?**

You can monitor and manage a Spring Boot application using **Spring Boot Actuator**, which provides various built-in endpoints such as:

* /actuator/health for application health status.
* /actuator/metrics for application metrics.
* /actuator/env for application environment details.

You can enable these endpoints by adding the spring-boot-starter-actuator dependency.

**Q112. How to implement caching in a Spring Boot application?**

Spring Boot supports caching using the @Cacheable annotation. To enable caching, add the following dependency:

<dependency>

<groupId>org.springframework.boot</groupId>

<artifactId>spring-boot-starter-cache</artifactId>

</dependency>

Then, configure a cache manager and use annotations like @Cacheable to cache results:

@Cacheable("books")

public Book getBook(Long id) {

// Code to fetch book from DB

}

**Q113. How to implement logging in a Spring Boot application?**

Spring Boot uses **SLF4J** with **Logback** by default. To enable logging, you just need to configure log levels in application.properties:

logging.level.org.springframework=INFO

logging.level.com.myapp=DEBUG

You can also configure your logging framework (Log4j, for example) by adding the necessary dependencies.

**Q114. How to implement scheduling in a Spring Boot application?**

Scheduling in Spring Boot can be implemented with the @Scheduled annotation. You can enable scheduling by adding @EnableScheduling to your configuration:

@Configuration

@EnableScheduling

public class SchedulingConfig {

@Scheduled(fixedRate = 5000)

public void task() {

System.out.println("Task executed every 5 seconds");

}

}

**Q115. How to implement messaging in a Spring Boot application?**

Spring Boot provides support for messaging with **Spring JMS**, **Kafka**, and **RabbitMQ**. To use messaging, add the necessary dependencies (e.g., spring-boot-starter-amqp for RabbitMQ), configure the messaging system, and use @RabbitListener or @JmsListener for receiving messages.

**Q116. How to implement reactive programming in a Spring Boot application?**

You can implement reactive programming using **Spring WebFlux**, which is designed to work with **reactive streams**. Add the following dependency for WebFlux:

<dependency>

<groupId>org.springframework.boot</groupId>

<artifactId>spring-boot-starter-webflux</artifactId>

</dependency>

Then, use Mono and Flux to represent asynchronous streams of data.

**Q117. How to implement real-time communication in a Spring Boot application?**

Real-time communication can be implemented using **WebSockets** or **Server-Sent Events (SSE)**. In Spring Boot, you can enable WebSocket support by adding the spring-boot-starter-websocket dependency and creating a WebSocket configuration class.

**Q118. How to manage application properties in a Spring Boot application?**

Application properties are managed using the application.properties or application.yml files. You can define configuration properties in these files and inject them into Spring beans using @Value or @ConfigurationProperties.

**Q119. How to handle cross-cutting concerns in a Spring Boot application?**

Cross-cutting concerns like logging, transaction management, and security can be handled using **AOP (Aspect-Oriented Programming)**. You can create aspects and use annotations like @Before, @After, and @Around to apply logic across multiple methods.

**Q120. How to handle authentication and authorization in a microservices architecture with Spring Boot?**

In a microservices architecture, authentication and authorization can be managed using **Spring Security** with **OAuth2** and **JWT** tokens. The spring-security-oauth2 library supports the implementation of OAuth2-based authentication and JWT for stateless token management.

I hope this helps! If you need further explanations or more details on any of these topics, feel free to ask.

Sure! Continuing from where we left off:

**Q121. How to handle long-running tasks in a Spring Boot application?**

Long-running tasks in a Spring Boot application can be handled using **asynchronous processing**. The @Async annotation can be used to run methods asynchronously. This allows the main thread to continue processing while the long-running task executes in the background.

Example:

@Async

public CompletableFuture<String> processLongTask() {

// Long-running task

return CompletableFuture.completedFuture("Task completed");

}

You will also need to enable asynchronous processing in your configuration:

@EnableAsync

@Configuration

public class AsyncConfig {

// Configure Async Executor if necessary

}

**Q122. How to monitor and troubleshoot performance issues in a Spring Boot application?**

To monitor and troubleshoot performance issues in a Spring Boot application, you can use:

* **Spring Boot Actuator**: Provides health checks, metrics, and application information.
* **Micrometer**: Provides metrics for monitoring and integration with tools like Prometheus, Datadog, and others.
* **Logging**: Set up appropriate logging levels and log aggregators like ELK stack (Elasticsearch, Logstash, Kibana) to monitor logs.
* **JVM Profiling**: Use tools like JVisualVM or JProfiler to analyze heap memory, garbage collection, and thread dumps.

Example of enabling some Actuator endpoints for monitoring:

management.endpoints.web.exposure.include=health,info,metrics

**Q123. List out the new features available in Spring Framework 4.0 and Spring Framework 5.0**

Some of the key new features in **Spring Framework 4.0** include:

* **Spring WebFlux**: For reactive programming and non-blocking I/O.
* **Groovy-based Beans**: Support for Groovy as a language for defining Spring beans.
* **Java 8 support**: Introduction of new features that leverage Java 8 like Lambda Expressions and functional style programming.

Key new features in **Spring Framework 5.0**:

* **Reactive Programming**: Enhanced support for reactive programming with **Spring WebFlux**.
* **Kotlin Support**: First-class support for Kotlin, allowing developers to use Kotlin in Spring projects.
* **RSocket**: A new protocol for building reactive microservices.
* **Functional Bean Registration**: Replacing XML configuration with functional programming paradigms.

**Q124. How do you ensure data integrity and consistency in a distributed microservices architecture with Spring Boot?**

In a distributed microservices architecture, ensuring data integrity and consistency can be challenging. Some strategies include:

* **Event-driven architecture**: Use events to synchronize data across services. Spring Cloud Stream and Kafka are useful for event-driven communication.
* **SAGA pattern**: Break up a distributed transaction into a series of smaller steps, using compensating transactions to ensure consistency.
* **Two-phase commit (2PC)**: In critical scenarios, use a two-phase commit protocol to manage distributed transactions (though this is not always recommended for performance reasons).
* **Eventual consistency**: Accept eventual consistency instead of strict consistency where appropriate, using idempotent operations to avoid duplicate data.

**Q125. How to handle WebSocket communication in Spring?**

WebSocket communication in Spring can be implemented with **Spring WebSocket**. This allows bi-directional, full-duplex communication between clients and servers over a single connection.

To enable WebSocket support in Spring Boot:

1. Add the dependency:

<dependency>

<groupId>org.springframework.boot</groupId>

<artifactId>spring-boot-starter-websocket</artifactId>

</dependency>

1. Configure WebSocket:

@Configuration

@EnableWebSocket

public class WebSocketConfig implements WebSocketConfigurer {

@Override

public void registerWebSocketHandlers(WebSocketHandlerRegistry registry) {

registry.addHandler(new MyWebSocketHandler(), "/ws").setAllowedOrigins("\*");

}

}

**Q126. How are mock frameworks such as Mockito or EasyMock used in Spring Boot?**

Mock frameworks like **Mockito** or **EasyMock** are used to create mock objects during unit testing. These mocks simulate the behavior of real objects and help test components in isolation.

Example using **Mockito**:

@RunWith(SpringRunner.class)

@SpringBootTest

public class MyServiceTest {

@Mock

private MyRepository myRepository;

@InjectMocks

private MyService myService;

@Test

public void testServiceMethod() {

when(myRepository.getData()).thenReturn("Mock Data");

String result = myService.getDataFromRepo();

assertEquals("Mock Data", result);

}

}

**Q127. How do you create RESTful APIs using Spring Boot?**

To create RESTful APIs in Spring Boot, you can use **Spring Web** along with **Spring MVC**. The @RestController and @RequestMapping annotations are used to define REST endpoints.

Example:

@RestController

@RequestMapping("/api")

public class MyRestController {

@GetMapping("/message")

public String getMessage() {

return "Hello, World!";

}

@PostMapping("/message")

public ResponseEntity<String> postMessage(@RequestBody String message) {

return new ResponseEntity<>(message, HttpStatus.CREATED);

}

}

**Q128. How do you secure a Spring Boot application?**

Securing a Spring Boot application can be achieved using **Spring Security**. Some key practices include:

* **Authentication**: Use username/password, OAuth2, or JWT for secure authentication.
* **Authorization**: Use roles and permissions to control access to resources.
* **CSRF Protection**: Enable CSRF protection for POST, PUT, DELETE requests.
* **HTTPS**: Enable HTTPS for secure communication.

Example using JWT for authentication:

@Configuration

@EnableWebSecurity

public class WebSecurityConfig extends WebSecurityConfigurerAdapter {

@Override

protected void configure(HttpSecurity http) throws Exception {

http.csrf().disable().authorizeRequests()

.antMatchers("/api/\*\*").authenticated()

.anyRequest().permitAll()

.and().httpBasic();

}

}

**Q129. How does Spring Boot support OAuth 2.0?**

Spring Boot supports OAuth 2.0 for authentication and authorization through **Spring Security OAuth2**. Spring Boot can act as both an OAuth2 Client and OAuth2 Authorization Server.

To use OAuth2 authentication, you can configure application.properties with the required OAuth2 provider details:

spring.security.oauth2.client.registration.google.client-id=your-client-id

spring.security.oauth2.client.registration.google.client-secret=your-client-secret

spring.security.oauth2.client.registration.google.scope=email

**Q130. How do you implement security in a Spring Boot application?**

To implement security in a Spring Boot application, you can use **Spring Security**, which provides authentication and authorization features.

You can configure Spring Security in the WebSecurityConfigurerAdapter class:

@Configuration

@EnableWebSecurity

public class SecurityConfig extends WebSecurityConfigurerAdapter {

@Override

protected void configure(HttpSecurity http) throws Exception {

http

.authorizeRequests()

.antMatchers("/admin/\*\*").hasRole("ADMIN")

.antMatchers("/user/\*\*").hasRole("USER")

.anyRequest().authenticated()

.and()

.formLogin();

}

}

**Q131. What is Spring Security?**

**Spring Security** is a powerful and customizable authentication and access control framework for Java applications. It provides security features like authentication, authorization, LDAP integration, and protection against attacks like CSRF, XSS, and session fixation.

**Q132. How Do You Configure Basic Authentication In Spring Security?**

Basic authentication can be configured in Spring Security as follows:

@Configuration

@EnableWebSecurity

public class WebSecurityConfig extends WebSecurityConfigurerAdapter {

@Override

protected void configure(HttpSecurity http) throws Exception {

http

.authorizeRequests()

.anyRequest().authenticated()

.and()

.httpBasic(); // Enable basic authentication

}

@Override

protected void configure(AuthenticationManagerBuilder auth) throws Exception {

auth.inMemoryAuthentication()

.withUser("user").password(passwordEncoder().encode("password")).roles("USER");

}

}

Let me know if you need further explanations or more topics covered!

Certainly! Continuing from where we left off:

**Q133. What Is CSRF Protection And How Is It Implemented In Spring Security?**

**CSRF (Cross-Site Request Forgery)** is an attack that tricks the user into performing actions they did not intend to, such as submitting forms or making changes in an application. Spring Security provides built-in protection against CSRF attacks by generating a unique token that must accompany each HTTP request.

To enable CSRF protection, Spring Security does it by default, but it can be disabled if necessary:

@Configuration

@EnableWebSecurity

public class WebSecurityConfig extends WebSecurityConfigurerAdapter {

@Override

protected void configure(HttpSecurity http) throws Exception {

http.csrf().disable() // Disable CSRF (not recommended for production)

.authorizeRequests()

.anyRequest().authenticated();

}

}

For secure applications, **CSRF protection** should be enabled. In a web application, this is usually handled via an HTTP header containing a CSRF token in requests (like forms).

**Q134. Explain the concept of Spring Security OAuth**

**Spring Security OAuth** is a module of Spring Security that provides support for OAuth 2.0 authentication and authorization. It enables secure API access by using **OAuth2** for token-based authentication and authorization.

* **OAuth 2.0 Authorization Code Flow**: Ideal for web applications.
* **Client Credentials Flow**: For server-to-server authentication.
* **Password Flow**: For direct user authentication (less secure and not recommended).

It includes the ability to implement an **OAuth2 Authorization Server** and an **OAuth2 Resource Server** for secure API access.

**Q135. What is JWT? How to implement it using Spring Boot Security?**

**JWT (JSON Web Token)** is a compact and self-contained way to represent information between two parties securely as a JSON object. It is widely used for **stateless authentication** in REST APIs.

Steps to implement JWT in Spring Boot:

1. Add JWT dependencies in pom.xml:

<dependency>

<groupId>io.jsonwebtoken</groupId>

<artifactId>jjwt</artifactId>

<version>0.11.5</version>

</dependency>

1. Create a utility class for generating and validating the token:

public class JwtUtil {

private String secretKey = "mySecretKey";

public String generateToken(String username) {

return Jwts.builder()

.setSubject(username)

.setIssuedAt(new Date())

.setExpiration(new Date(System.currentTimeMillis() + 1000 \* 60 \* 60))

.signWith(SignatureAlgorithm.HS256, secretKey)

.compact();

}

public Claims extractClaims(String token) {

return Jwts.parser()

.setSigningKey(secretKey)

.parseClaimsJws(token)

.getBody();

}

public String extractUsername(String token) {

return extractClaims(token).getSubject();

}

public boolean isTokenExpired(String token) {

return extractClaims(token).getExpiration().before(new Date());

}

public boolean validateToken(String token, String username) {

return (username.equals(extractUsername(token)) && !isTokenExpired(token));

}

}

1. Configure a filter to check the JWT in each request:

public class JwtAuthenticationFilter extends OncePerRequestFilter {

private JwtUtil jwtUtil;

public JwtAuthenticationFilter(JwtUtil jwtUtil) {

this.jwtUtil = jwtUtil;

}

@Override

protected void doFilterInternal(HttpServletRequest request, HttpServletResponse response, FilterChain filterChain)

throws ServletException, IOException {

String token = request.getHeader("Authorization");

if (token != null && token.startsWith("Bearer ")) {

token = token.substring(7);

String username = jwtUtil.extractUsername(token);

if (username != null && SecurityContextHolder.getContext().getAuthentication() == null) {

if (jwtUtil.validateToken(token, username)) {

UsernamePasswordAuthenticationToken authentication = new UsernamePasswordAuthenticationToken(username, null, new ArrayList<>());

SecurityContextHolder.getContext().setAuthentication(authentication);

}

}

}

filterChain.doFilter(request, response);

}

}

1. Add the filter to your security configuration:

@Configuration

@EnableWebSecurity

public class SecurityConfig extends WebSecurityConfigurerAdapter {

@Autowired

private JwtUtil jwtUtil;

@Override

protected void configure(HttpSecurity http) throws Exception {

http.addFilterBefore(new JwtAuthenticationFilter(jwtUtil), UsernamePasswordAuthenticationFilter.class)

.authorizeRequests()

.antMatchers("/auth/\*\*").permitAll()

.anyRequest().authenticated();

}

}

**Q136. What are conditional annotations in Spring Boot?**

Conditional annotations in Spring Boot help you configure beans or components based on specific conditions. This can be useful for loading certain beans only under specific circumstances (e.g., certain profiles, properties, etc.).

Examples:

* @ConditionalOnProperty: Bean will be loaded only if a specific property is set in the application.properties.

@Configuration

@ConditionalOnProperty(name = "my.custom.property", havingValue = "true")

public class CustomConfiguration {

// Bean definitions here

}

* @ConditionalOnClass: Bean will be loaded only if the specified class is present in the classpath.

@Configuration

@ConditionalOnClass(MyCustomClass.class)

public class MyCustomConfiguration {

// Bean definitions here

}

* @ConditionalOnMissingBean: Bean will be loaded only if there is no other bean of the same type in the context.

@Configuration

@ConditionalOnMissingBean(MyService.class)

public class MyServiceConfiguration {

// Bean definitions here

}

**Q137. What is the default server provided by Spring Boot?**

By default, Spring Boot uses **Tomcat** as the embedded HTTP server. It provides an embedded servlet container to run Spring Boot applications without needing to deploy them to an external server.

You can change the embedded server to others like **Jetty** or **Undertow** by adding the respective dependencies and excluding Tomcat.

For example, to use Jetty:

<dependency>

<groupId>org.springframework.boot</groupId>

<artifactId>spring-boot-starter-jetty</artifactId>

</dependency>

<dependency>

<groupId>org.springframework.boot</groupId>

<artifactId>spring-boot-starter-tomcat</artifactId>

<scope>provided</scope>

</dependency>

**Q138. How does Spring Boot support the development of RESTful web services?**

Spring Boot simplifies the development of RESTful web services by providing embedded servers, auto-configuration, and easy integration with **Spring MVC** and **Spring Data REST**. With Spring Boot, you can quickly expose RESTful APIs using @RestController and @RequestMapping annotations, reducing boilerplate code.

Example:

@RestController

@RequestMapping("/api")

public class MyRestController {

@GetMapping("/hello")

public String sayHello() {

return "Hello, Spring Boot!";

}

}

Additionally, **Spring Data REST** helps expose repositories as REST APIs automatically.

**Q139. Explain the role of EnableAutoConfiguration in Spring Boot app and how does Spring achieve auto configuration internally?**

The @EnableAutoConfiguration annotation tells Spring Boot to automatically configure beans based on the classpath and other settings in the environment. This reduces the need for manual configuration and setup.

Internally, Spring Boot uses a combination of **conditional annotations** (like @ConditionalOnClass, @ConditionalOnBean) and **spring.factories** files to enable auto-configuration.

For example, if Spring Boot detects that H2 database is on the classpath, it auto-configures an in-memory H2 database without requiring any explicit configuration.

**Q140. Are you aware of actuator endpoints?**

Yes! Spring Boot Actuator provides several endpoints to help monitor and manage your application. These endpoints provide information such as health checks, application metrics, system properties, and more.

Some common actuator endpoints:

* /actuator/health: Shows the health status of the application.
* /actuator/metrics: Provides metrics data such as JVM memory usage, HTTP requests, etc.
* /actuator/env: Displays environment properties and configuration.
* /actuator/info: Custom information about the application (e.g., build version).

To enable Actuator endpoints:

management.endpoints.web.exposure.include=health,metrics,info

Would you like to continue from here or dive into any specific question in more detail? Let me know!

Sure! Continuing from where we left off:

**Q141. What is the dependency name for actuator?**

The dependency for Spring Boot Actuator is:

<dependency>

<groupId>org.springframework.boot</groupId>

<artifactId>spring-boot-starter-actuator</artifactId>

</dependency>

This dependency enables you to access various management and monitoring endpoints for your Spring Boot application.

**Q142. Can we secure these actuator endpoints? How can we secure them?**

Yes, you can secure actuator endpoints to restrict unauthorized access. By default, most actuator endpoints are exposed without security, but you can secure them with Spring Security.

To secure actuator endpoints, you can configure Spring Security to apply authentication or authorization rules. For example:

@Configuration

@EnableWebSecurity

public class SecurityConfig extends WebSecurityConfigurerAdapter {

@Override

protected void configure(HttpSecurity http) throws Exception {

http

.authorizeRequests()

.antMatchers("/actuator/health", "/actuator/info").permitAll() // Open health and info

.antMatchers("/actuator/\*\*").authenticated() // Secure all other actuator endpoints

.and()

.httpBasic(); // Use basic authentication

}

}

Additionally, you can configure which actuator endpoints should be exposed and which should be secured using properties in application.properties or application.yml.

**Q143. What strategies would be used to optimize the performance of Spring Boot applications?**

To optimize the performance of a Spring Boot application, you can consider the following strategies:

1. **Disable Unnecessary Features**: Disable unused Spring Boot auto-configurations by using @EnableAutoConfiguration(exclude = {...}) or properties in application.properties.
2. **Profile-Based Configuration**: Use different profiles (e.g., dev, prod) to set specific configurations.
3. **JVM Tuning**: Use optimal JVM parameters (heap size, garbage collection).
4. **Caching**: Implement caching for frequently used data with @Cacheable.
5. **Asynchronous Processing**: Use @Async for long-running tasks.
6. **Database Optimization**: Optimize database queries, use connection pooling (e.g., HikariCP).
7. **Enable HTTP/2**: Enable HTTP/2 for faster communication (Spring Boot 2.x supports HTTP/2).
8. **Reduce Startup Time**: Minimize the number of beans in the context and use lazy initialization.
9. **Gzip Compression**: Enable Gzip compression to reduce the payload size of responses.
10. **Use Spring Boot Profiles**: Profile-based tuning to optimize resources in various environments (e.g., dev vs prod).

**Q144. What is Aspect Oriented Programming (AOP)?**

**Aspect-Oriented Programming (AOP)** is a programming paradigm that provides a way to modularize cross-cutting concerns, such as logging, transaction management, security, and exception handling. It allows you to define **aspects**, which are modular pieces of functionality that are applied to specific points in your application, such as method execution.

In Spring, AOP is implemented using proxies that can intercept method calls. You can use annotations like @Before, @After, @Around to define advice (actions that should occur before, after, or around the execution of a method).

**Q145. Can you give a use case of AOP?**

A common use case of **AOP** is **logging**. Suppose you want to log the execution time of every method in a service. Instead of manually adding logging code to each method, you can use AOP to automatically log method execution:

Example:

@Aspect

@Component

public class LoggingAspect {

@Around("execution(\* com.example.service.\*.\*(..))")

public Object logExecutionTime(ProceedingJoinPoint joinPoint) throws Throwable {

long start = System.currentTimeMillis();

Object proceed = joinPoint.proceed();

long end = System.currentTimeMillis();

System.out.println(joinPoint.getSignature() + " executed in " + (end - start) + "ms");

return proceed;

}

}

This will log the execution time of each method in the com.example.service package.

**Q146. Can you explain how Spring Boot profiles work?**

**Spring Boot profiles** allow you to define different configurations for different environments, such as development, testing, and production. You can specify different application.properties or application.yml configurations for each profile and activate them based on the environment.

Example of using profiles in application.properties:

# application-dev.properties

server.port=8081

spring.datasource.url=jdbc:h2:mem:testdb

# application-prod.properties

server.port=8080

spring.datasource.url=jdbc:mysql://prod-database

To activate a profile, you can specify it as a command-line parameter or set it in application.properties:

spring.profiles.active=dev

**Q147. Which file do you use: yml or properties in your current project?**

Both application.properties and application.yml files serve the same purpose: they are used to configure the Spring Boot application. The choice between the two depends on preference and project needs.

* **application.properties**: A simple key-value pair format. Preferred by some developers for its simplicity.
* **application.yml**: A hierarchical format that uses indentation. Preferred for more complex configurations.

Example application.yml:

server:

port: 8080

spring:

datasource:

url: jdbc:mysql://localhost:3306/mydb

**Q148. Do we have any benefit of using yml over properties file?**

Yes, yml (YAML) files have some advantages over .properties files:

1. **Hierarchical structure**: YAML allows you to represent nested properties in a more readable way, which can be very helpful for complex configurations.
2. **Better readability**: YAML's indentation-based structure can make configurations easier to understand compared to flat properties files.
3. **Reduced verbosity**: YAML files tend to be more concise than properties files, as they don’t require as many repetitions for nested properties.

However, .properties files are still widely used and simple for most use cases.

**Q149. Can you explain component scan and how would you prevent a specific package from being scanned?**

**Component scanning** is a mechanism in Spring where the framework automatically discovers and registers beans from your classpath based on annotations like @Component, @Service, @Repository, and @Controller.

By default, Spring Boot performs a component scan from the main application class and its package.

To exclude specific packages from the scan, you can use @ComponentScan with the excludeFilters attribute:

@SpringBootApplication

@ComponentScan(excludeFilters = @ComponentScan.Filter(type = FilterType.REGEX, pattern = "com.example.exclude.\*"))

public class MyApplication {

public static void main(String[] args) {

SpringApplication.run(MyApplication.class, args);

}

}

This configuration will exclude all classes in the com.example.exclude package from being scanned.

**Q150. Can you explain what is the default embedded server provided by Spring Boot?**

By default, Spring Boot uses **Apache Tomcat** as the embedded servlet container for serving web applications. Tomcat is the most commonly used embedded server in Spring Boot, as it is lightweight, easy to use, and requires minimal configuration.

However, Spring Boot also supports other embedded servers such as **Jetty** and **Undertow**, which you can switch to by adding the corresponding dependency and excluding Tomcat.

**Q151. Can we change the default embedded server?**

Yes, Spring Boot allows you to change the default embedded server (Tomcat) by adding the appropriate starter for the server you want to use. For example:

* **Jetty**:
* <dependency>
* <groupId>org.springframework.boot</groupId>
* <artifactId>spring-boot-starter-jetty</artifactId>
* </dependency>
* <dependency>
* <groupId>org.springframework.boot</groupId>
* <artifactId>spring-boot-starter-tomcat</artifactId>
* <scope>provided</scope>
* </dependency>
* **Undertow**:
* <dependency>
* <groupId>org.springframework.boot</groupId>
* <artifactId>spring-boot-starter-undertow</artifactId>
* </dependency>

By adding these dependencies, Tomcat will be replaced by the selected embedded server (Jetty or Undertow).

**Q152. How does AOP differ from traditional programming models?**

AOP (Aspect-Oriented Programming) differs from traditional (imperative) programming models in that it separates **cross-cutting concerns** (such as logging, transactions, security) from the main business logic. Traditional programming involves embedding such concerns directly into the logic, which can lead to code duplication, maintenance issues, and reduced readability.

In AOP, these concerns are modularized into **aspects**, which are then applied declaratively to methods or classes. This leads to cleaner, more maintainable code, as the concerns are handled separately.

**Q153. How to create a global exception handler in a Spring Boot application?**

In Spring Boot, you can create a global exception handler using @ControllerAdvice. This allows you to handle exceptions thrown from any controller and return a consistent response.

Example:

@ControllerAdvice

public class GlobalExceptionHandler {

@ExceptionHandler(Exception.class)

public ResponseEntity<String> handleException(Exception ex) {

return new ResponseEntity<>("An error occurred: " + ex.getMessage(), HttpStatus.INTERNAL\_SERVER\_ERROR);

}

}

This will handle any exception thrown by the controller and return a custom error message.

**Q154. How will you call a RESTful web service from a Spring Boot application?**

In a Spring Boot application, you can use RestTemplate or WebClient to call REST

ful web services.

Using RestTemplate:

@RestController

public class MyController {

@Autowired

private RestTemplate restTemplate;

@GetMapping("/call-api")

public String callApi() {

String url = "https://api.example.com/data";

return restTemplate.getForObject(url, String.class);

}

}

Alternatively, you can use **WebClient**, which is more modern and supports reactive programming:

@Autowired

private WebClient.Builder webClientBuilder;

@GetMapping("/call-api")

public Mono<String> callApi() {

return webClientBuilder.baseUrl("https://api.example.com")

.build()

.get()

.uri("/data")

.retrieve()

.bodyToMono(String.class);

}

**Q155. What is the @SpringBootApplication annotation used for?**

The @SpringBootApplication annotation is a convenience annotation that combines:

* @EnableAutoConfiguration: Enables Spring Boot’s auto-configuration mechanism.
* @ComponentScan: Automatically scans for Spring components (beans) in the package where the application is located.
* @Configuration: Marks the class as a source of bean definitions.

This annotation is usually placed on the main class that starts the Spring Boot application.

**Q156. How do you define a custom banner in Spring Boot?**

You can define a custom banner for your Spring Boot application by placing a banner.txt file in the src/main/resources folder. The contents of the file can be anything, such as ASCII art, a logo, or text.

Alternatively, you can define a custom banner programmatically in your application:

@SpringBootApplication

public class MyApplication {

public static void main(String[] args) {

SpringApplication app = new SpringApplication(MyApplication.class);

app.setBanner((environment, sourceClass, out) -> out.println("Welcome to My Custom Banner!"));

app.run(args);

}

}

**Q157. How do you handle application configuration in different environments in Spring Boot?**

You can handle application configuration in different environments by using Spring profiles. Define different application-{profile}.properties or application-{profile}.yml files for each environment. For example, application-dev.properties for development and application-prod.properties for production.

To activate a specific profile:

# In application.properties or application.yml

spring.profiles.active=dev

Spring Boot will then load the configuration specific to the active profile.

**Q158. What is the @Bean annotation used for in Spring?**

The @Bean annotation is used to explicitly define a bean in a Spring configuration class. It tells Spring that the method will return a bean, and Spring will manage its lifecycle.

Example:

@Configuration

public class AppConfig {

@Bean

public MyService myService() {

return new MyServiceImpl();

}

}

This will define a MyService bean in the Spring context.

**Q159. Can you explain the @Autowired annotation and how does Spring Boot resolve dependencies?**

The @Autowired annotation is used by Spring to automatically inject the required dependencies into a class. Spring resolves the dependency by searching for a matching bean in the application context and injecting it.

Example:

@Component

public class MyService {

@Autowired

private MyRepository myRepository;

}

Spring will automatically inject an instance of MyRepository into the myRepository field.

**Q160. How do you perform validation in Spring Boot?**

Spring Boot provides powerful support for validation using JSR-303 (Bean Validation). You can use annotations like @NotNull, @Size, @Email, and others to validate fields in your model class.

Example:

public class User {

@NotNull

private String name;

@Email

private String email;

// Getters and Setters

}

To enable validation, you must annotate your controller method parameter with @Valid and handle validation errors with BindingResult.

Example:

@PostMapping("/user")

public ResponseEntity<String> createUser(@Valid @RequestBody User user, BindingResult result) {

if (result.hasErrors()) {

return ResponseEntity.badRequest().body("Invalid input");

}

// Continue with user creation

}

Let me know if you need further clarification or would like to continue with the next set of questions!