Spring RESTful API Exception Handling

By

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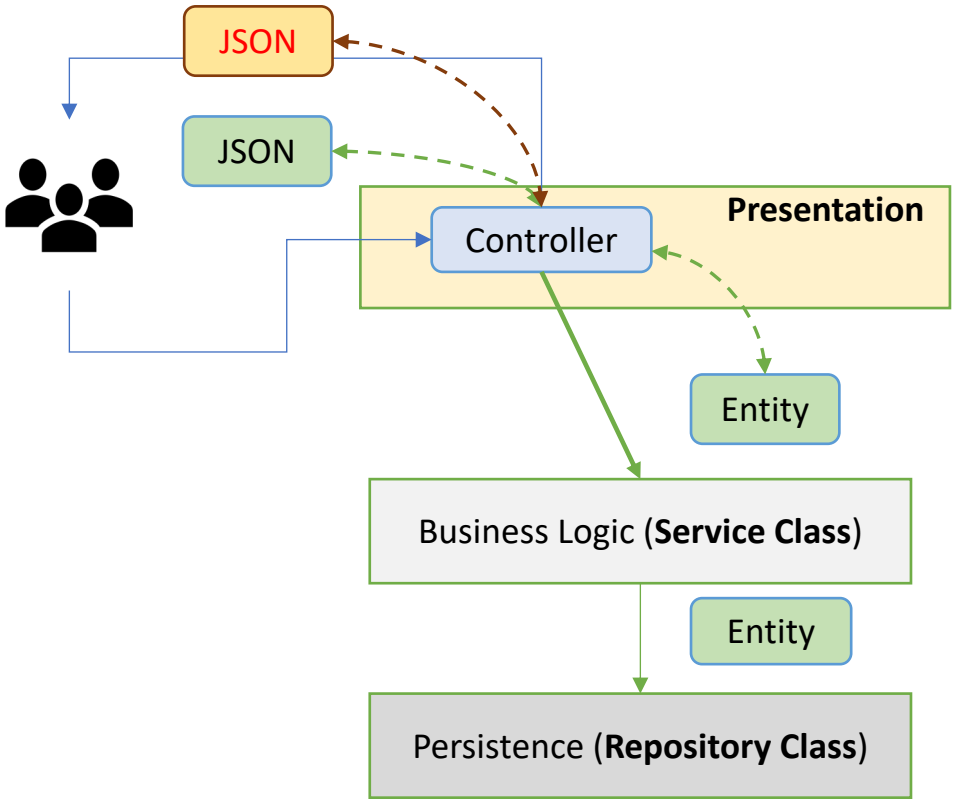
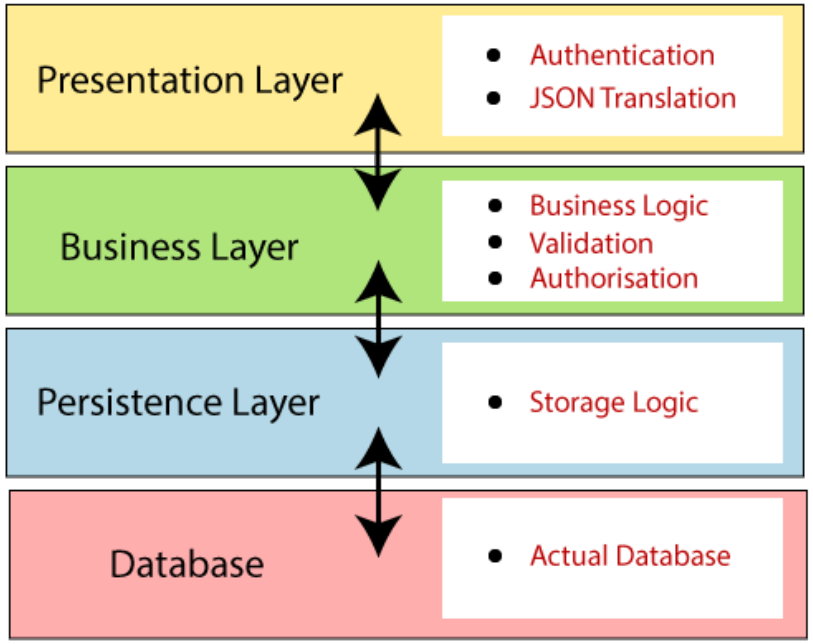
Spring Boot Layer Architectures





HTTP Status Codes

- When a client makes a request to an HTTP server - and the server successfully receives the request - the server must notify the client if the request was successfully handled or not.
- HTTP accomplishes this with five categories of status codes:
  - 100-level (Informational) - server acknowledges a request
  - 200-level (Success) - server completed the request as expected
  - 300-level (Redirection) - client needs to perform further actions to complete the request
  - 400-level (Client error) - client sent an invalid request
  - 500-level (Server error) - server failed to fulfill a valid request due to an error with server
- Based on the response code, a client can surmise the result of a particular request.

Handling Errors

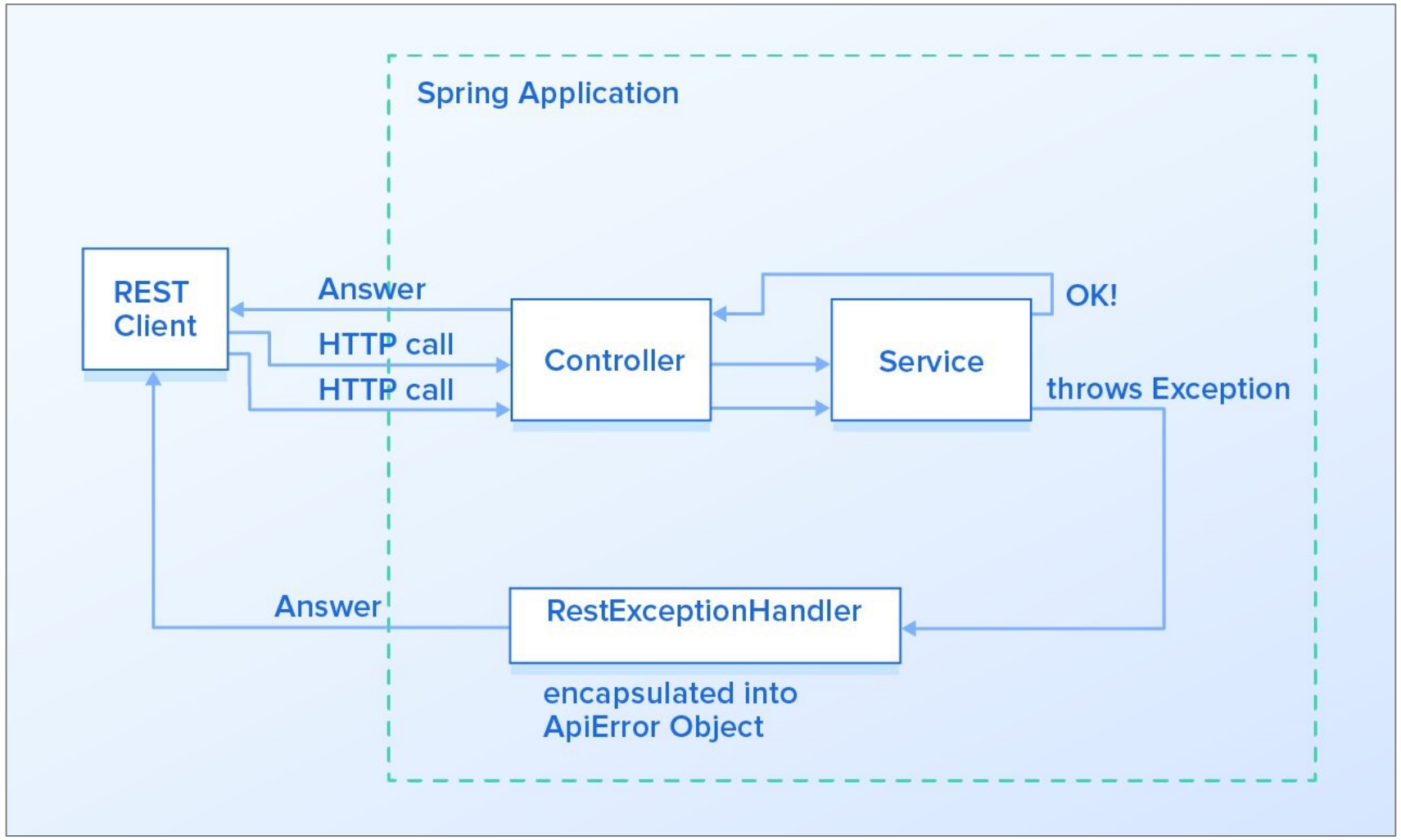
- The first step in handling errors is to provide a client with a proper **status code**. Additionally, we may need to provide more information in the response body.
- Basic Responses
  - The simplest way we handle errors is to respond with an appropriate status code.
  - Here are some common response codes:
    - 400 Bad Request - client sent an invalid request, such as lacking required request body or parameter
    - 401 Unauthorized - client failed to authenticate with the server
    - 403 Forbidden - client authenticated but does not have permission to access the requested resource
    - 404 Not Found - the requested resource does not exist
    - 412 Precondition Failed - one or more conditions in the request header fields evaluated to false
    - 500 Internal Server Error - a generic error occurred on the server
    - 503 Service Unavailable - the requested service is not available

Standardized Response Bodies

- In an effort to standardize REST API error handling, the IETF devised RFC 7807, which creates a generalized error-handling schema.
- This schema is composed of five parts:
  - type - a URI identifier that categorizes the error
  - title - a brief, human-readable message about the error
  - status - the HTTP response code (optional)
  - detail - a human-readable explanation of the error
  - instance - a URI that identifies the specific occurrence of the error

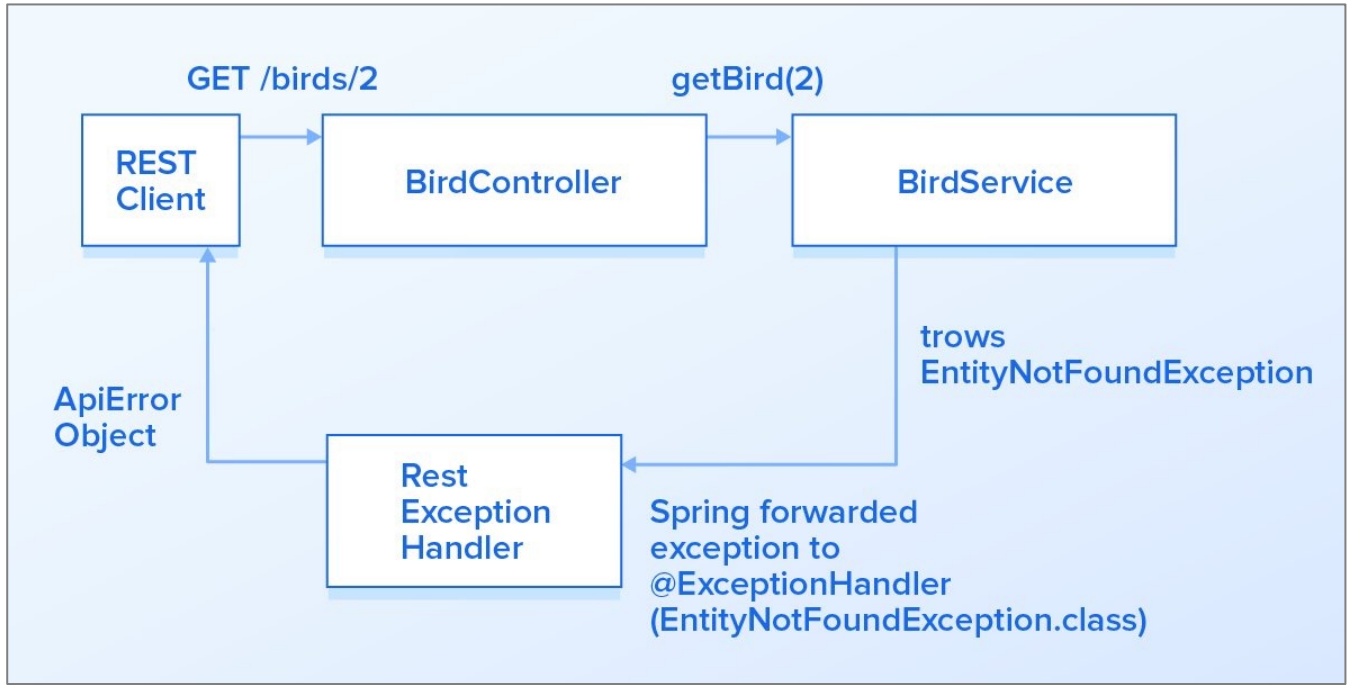
```
{
    "type": "/errors/incorrect-user-pass",
    "title": "Incorrect username or password.",
    "status": 401,
    "detail": "Authentication failed due to incorrect username or password.",
    "instance": "/login/log/abc123"
}
```

Rest Api - Exception Handling



Exception Handling

- Handling exceptions is an important part of building a robust application.
- Spring Boot provides tools to handle exceptions beyond simple ‘try-catch’ blocks.
  - @ResponseStatus
  - @ExceptionHandler
  - @ControllerAdvice



Spring Boot’s Default Exception Handling Mechanism

server.error.include-stacktrace=*always*

Body Cookies Headers (4) Test Results

Pretty Raw Preview Visualize JSON


```
1  {
2      "timestamp": "2023-03-19T03:20:25.325+00:00",
3      "status": 500,
4      "error": "Internal Server Error",
5      "trace": "org.springframework.web.client.HttpClientErrorExcepti
           lambda$getProductById$0(ProductService.java:25)\n\tat java.l
           services.ProductService.getProductById(ProductService.java:2
           (ProductController.java:56)\n\tat java.base/jdk.internal.re
           java.base/java.lang.reflect.Method.invoke(Method.java:577)\n
           (InvocableHandlerMethod.java:207)\n\tat org.springframework
           java:152)\n\tat org.springframework.web.servlet.mvc.method.a
           (ServletInvocableHandlerMethod.java:117)\n\tat org.springfra
           invokeHandlerMethod(RequestMappingHandlerAdapter.java:884)\n
```


server.error.include-stacktrace=*on_param*
server.error.include-exception=true

Body Cookies Headers (4) Test Results

Pretty Raw Preview Visualize JSON


```
1  {
2      "timestamp": "2023-03-19T03:42:00.775+00:00",
3      "status": 500,
4      "error": "Internal Server Error",
5      "exception": "org.springframework.web.client.HttpClientErrorI
6      "message": "404 1 does not exists !!!",
7      "path": "/api/products/dtos/1"
8  }
```


Enum Constants

Enum Constant	Description
ALWAYS	Always add stacktrace information.
NEVER	Never add stacktrace information.
ON_PARAM	Add stacktrace attribute when the appropriate request parameter is not "false".

@ResponseStatus

- As the name suggests, @ResponseStatus allows us to modify the HTTP status of our response. It can be applied in the following places:
  - On the exception class itself
  - Along with the @ExceptionHandler annotation on methods
  - Along with the @ControllerAdvice annotation on classes
- In this section, we'll be looking at the first case only.

```
@ResponseStatus(value = HttpStatus.NOT_FOUND)
public class ItemNotFoundException extends RuntimeException {
   public ItemNotFoundException(String message) {
      super(message);
   }
```

Pretty Raw Preview Visualize JSON


```
1 {
2     "timestamp": "2023-03-19T04:16:31.877+00:00",
3     "status": 404,
4     "error": "Not Found",
5     "exception": "com.demo.apidemo.exceptions.ItemNotFoundExcep
6     "message": "Product code: 1 does not exists !!!",
7     "path": "/api/products/dtos/1"
8 }
```


```
public Product getProductById(String productCode) {
   return repo.findById(productCode).orElseThrow(
         ()->new ItemNotFoundException("Product code: "+ productCode + " does not exists !!!"));
}
```

Another way to achieve the same is by extending the ResponseStatusException class

@ResponseStatus, in combination with the server.error configuration properties, allows us to manipulate almost all the fields in our Spring-defined error response payload.

```
import org.springframework.http.HttpStatus;
import org.springframework.web.server.ResponseStatusException;

public class ItemNotFoundException extends ResponseStatusException {

   public ItemNotFoundException(String message){
      super(HttpStatus.NOT_FOUND, message);
   }
}
```

@ExceptionHandler

- The @ExceptionHandler annotation gives us a lot of flexibility in terms of handling exceptions.
- For starters, to use it, we simply need to create a method either in the controller itself or in a @RestControllerAdvice class and annotate it with @ExceptionHandler:

```
public class ItemNotFoundException extends RuntimeException {
   public ItemNotFoundException(String message) {
      super(message);
   }
  @Override
   public synchronized Throwable fillInStackTrace() {
      return this;
   }
```

```
@RestController
public class ProductController {
 :
    @ExceptionHandler(ItemNotFoundException.class)
    @ResponseStatus(HttpStatus.NOT_FOUND)
     public ItemNotFoundException handleItemNotFound (
         ItemNotFoundException exception) {
          return exception;
     }
```

Body Cookies Headers (5) Test Results (0/1)

Pretty Raw Preview Visualize JSON


```
1 {
2     "cause": null,
3     "stackTrace": [],
4     "message": "Product id 'S18_3020' does not exist !!!",
5     "suppressed": [],
6     "localizedMessage": "Product id 'S18_3020' does not exist !!!"
7 }
```

Exception Error Code

- Now, let’s finalize an error response payload for our APIs. In case of any error, clients usually expect two things:
  - An error code that tells the client what kind of error it is. Error codes can be used by clients in their code to drive some business logic based on it.
    - Usually, error codes are standard HTTP status codes, but we have also seen APIs returning custom errors code likes E001.
  - An additional human-readable message which gives more information on the error and even some hints on how to fix them or a link to API docs.
- We will also add an optional stackTrace field which will help us with debugging in the development environment.

Handling validation errors in the response.

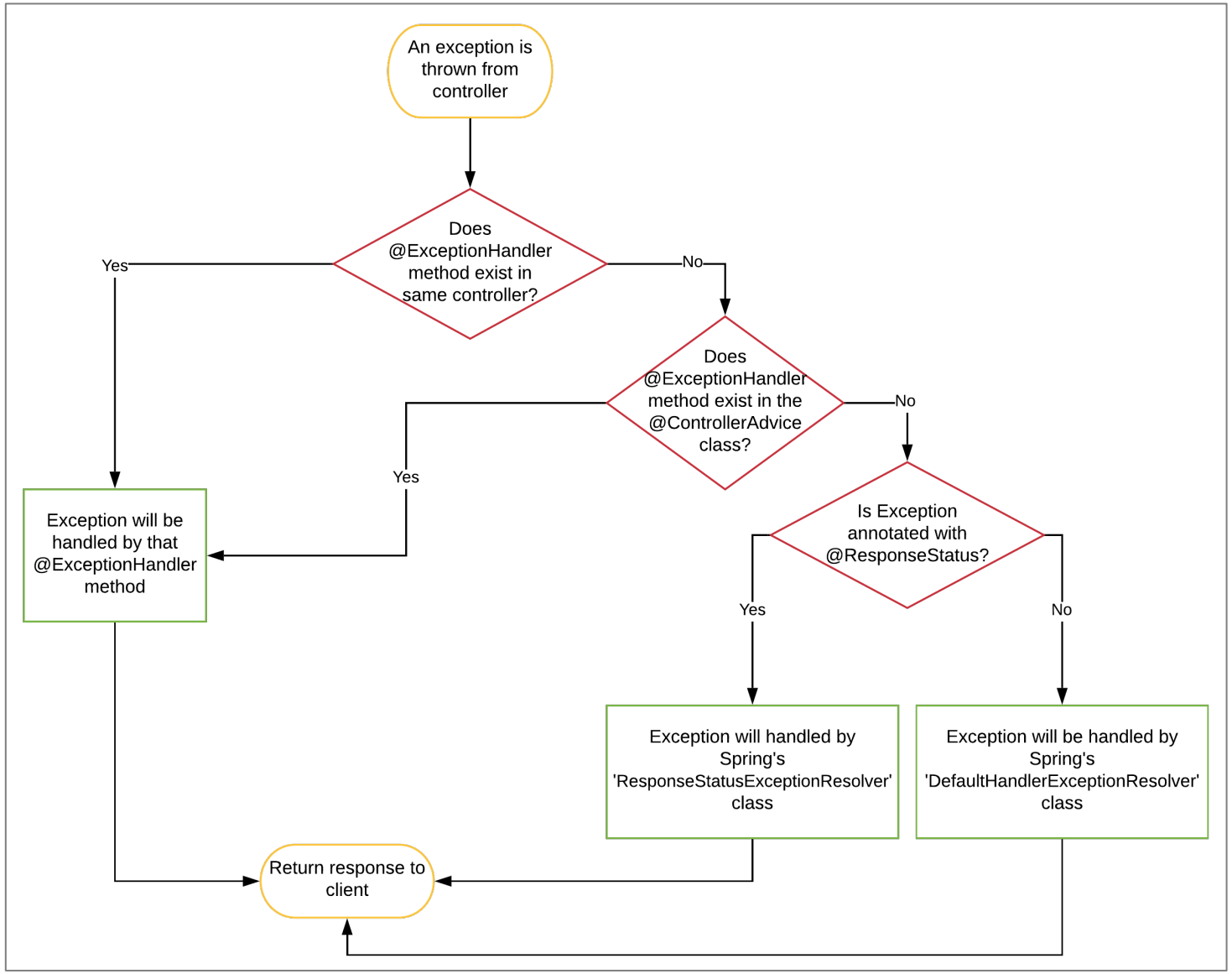
```java
@Getter
@Setter
@RequiredArgsConstructor
@JsonInclude(JsonInclude.Include.NON_NULL)
public class ErrorResponse {
   private final int status;
   private final String message;
   private final String instance;
   private String stackTrace;
   private List<ValidationError> errors;

   @Getter
   @Setter
   @RequiredArgsConstructor
   private static class ValidationError {
      private final String field;
      private final String message;
   }
   public void addValidationError(String field, String message){
      if(Objects.isNull(errors)){
         errors = new ArrayList<>();
      }
      errors.add(new ValidationError(field, message));
   }
}
```

```java
@ExceptionHandler(ItemNotFoundException.class)
@ResponseStatus(code = HttpStatus.NOT_FOUND)
public ResponseEntity<ErrorResponse>
handleItemNotFound(ItemNotFoundException ex, WebRequest request) {
    ErrorResponse er = new
ErrorResponse(HttpStatus.NOT_FOUND.value(), ex.getMessage(),
             request.getDescription(false));
return ResponseEntity.status(HttpStatus.NOT_FOUND).body(er);
}
```

@RestControllerAdvice

- The term 'Advice' comes from Aspect-Oriented Programming (AOP) which allows us to inject cross-cutting code (called "advice") around existing methods. A controller advice allows us to intercept and modify the return values of controller methods, in our case to handle exceptions.
- Controller advice classes allow us to apply exception handlers to more than one or all controllers in our application:
- If we want to selectively apply or limit the scope of the controller advice to a particular controller, or a package, we can use the properties provided by the annotation:
  - @RestControllerAdvice("com.reflectoring.controller"): we can pass a package name or list of package names in the annotation’s value or basePackages parameter. With this, the controller advice will only handle exceptions of this package’s controllers.
  - @RestControllerAdvice(assignableTypes={Controller.class}): only controllers specify by assignableType will be handled by the controller advice.

How Does Spring Process The Exceptions?



@RestControllerAdvice (1)

```
@RestControllerAdvice
public class GlobalExceptionHandler extends ResponseEntityExceptionHandler {

    @ExceptionHandler(ItemNotFoundException.class)
    @ResponseStatus(HttpStatus.NOT_FOUND)
    public ResponseEntity<ErrorResponse> handleItemNotFoundException(
            ItemNotFoundException exception, WebRequest request) {
        return buildErrorResponse(exception, HttpStatus.NOT_FOUND, request);
    }
```

@ControllerAdvice (2)

```
@ExceptionHandler(MethodArgumentNotValidException.class)
@ResponseStatus(HttpStatus.UNPROCESSABLE_ENTITY)
public ResponseEntity<ErrorResponse> handleMethodArgumentNotValid(
      MethodArgumentNotValidException ex,
      WebRequest request
) {
   ErrorResponse errorResponse = new ErrorResponse(
         HttpStatus.UNPROCESSABLE_ENTITY.value(),
         "Validation error. Check 'errors' field for details.“, request.getDescription(false)
   );

   for (FieldError fieldError : ex.getBindingResult().getFieldErrors()) {
      errorResponse.addValidationError(fieldError.getField(),
            fieldError.getDefaultMessage());
   }
   return ResponseEntity.unprocessableEntity().body(errorResponse);
}
```

@ControllerAdvice (3)

```
@ExceptionHandler(Exception.class)
@ResponseStatus(HttpStatus.INTERNAL_SERVER_ERROR)
public ResponseEntity<ErrorResponse> handleAllUncaughtException(
      Exception exception, WebRequest request) {


   return buildErrorResponse(
         exception, "Unknown error occurred", HttpStatus.INTERNAL_SERVER_ERROR,  request
   );
}
```

@ControllerAdvice (4)

```
private ResponseEntity<ErrorResponse> buildErrorResponse(
      Exception exception, HttpStatus httpStatus, WebRequest request) {
   return buildErrorResponse( exception, exception.getMessage(), httpStatus, request);
}

private ResponseEntity<ErrorResponse> buildErrorResponse(
      Exception exception, String message, HttpStatus httpStatus, WebRequest request) {

     ErrorResponse errorResponse = new ErrorResponse(httpStatus.value(), message,
           request.getDescription(false)
   );

   return ResponseEntity.status(httpStatus).body(errorResponse);
}
```