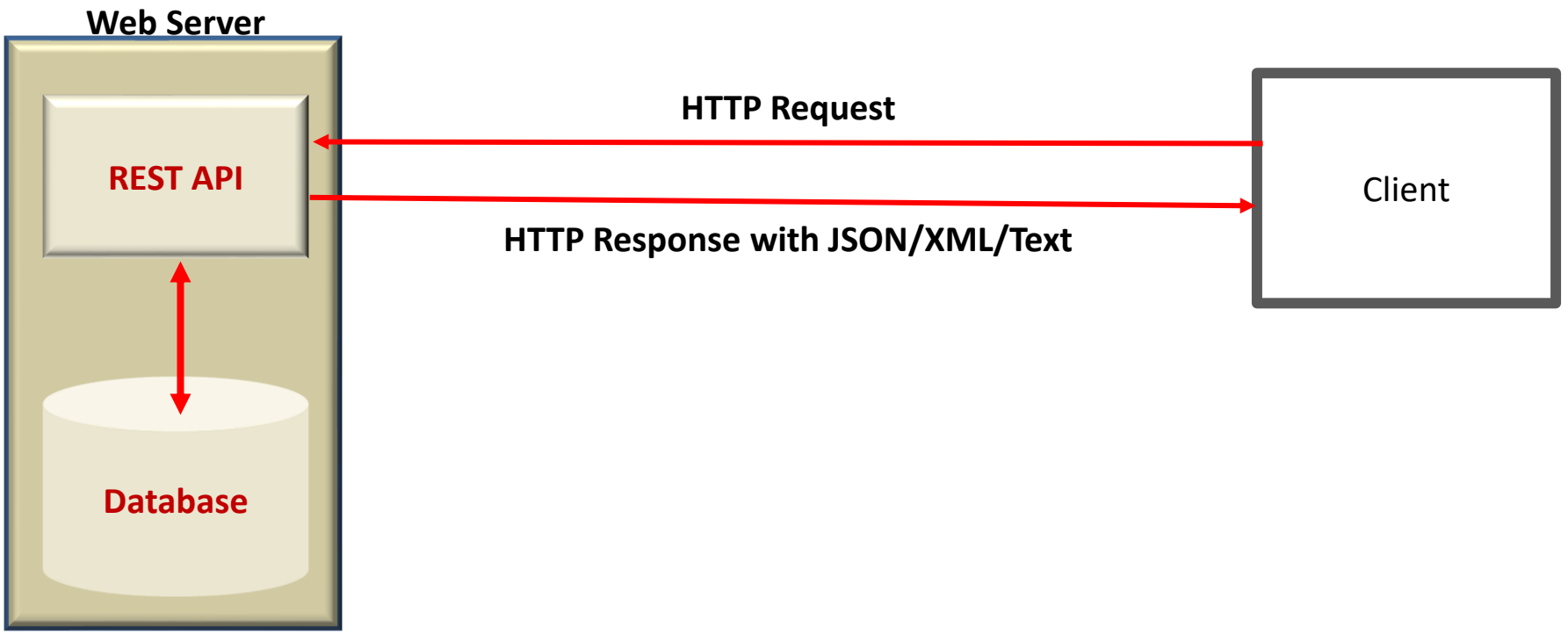
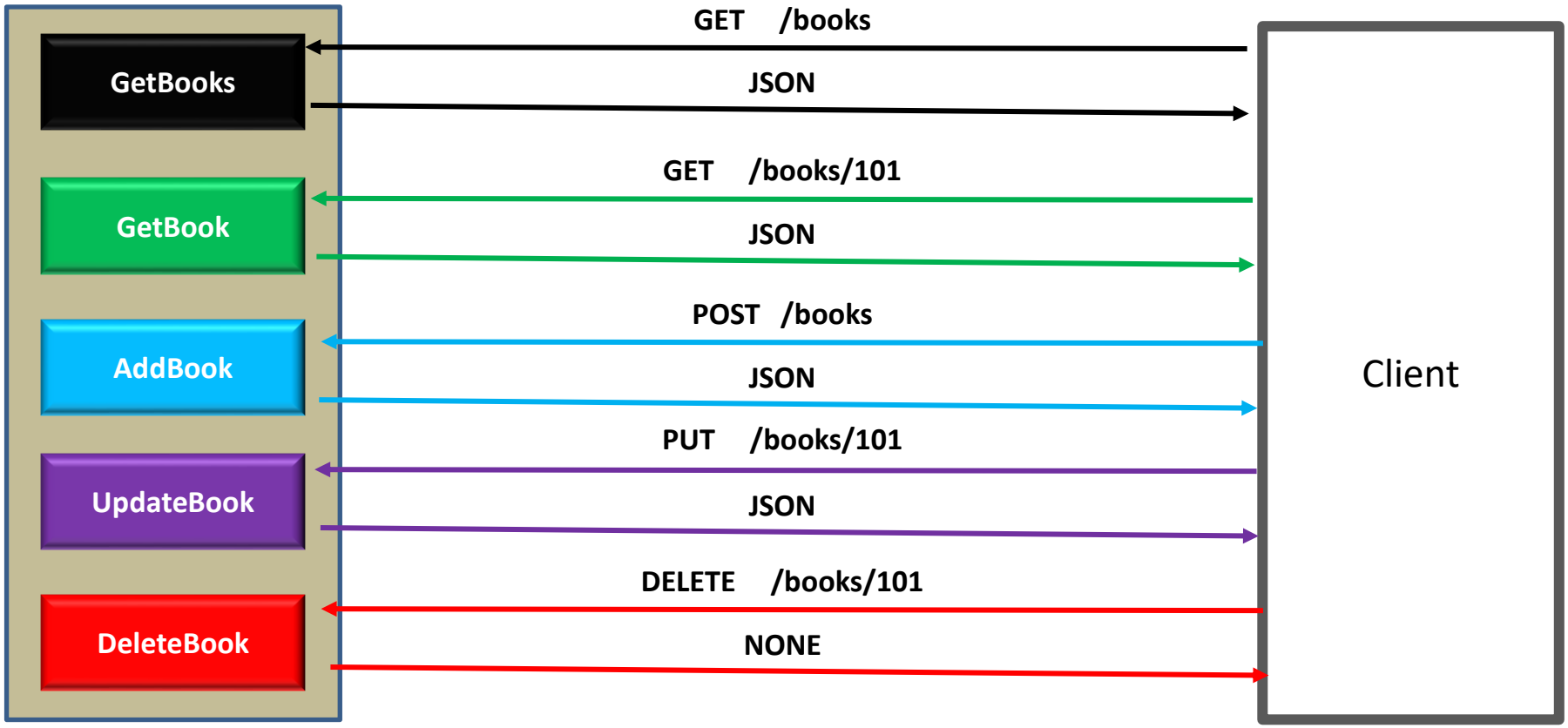
What is REST

- A REST API (also known as RESTful API) is an application programming interface (API or web API) that conforms to the constraints of REST architectural style and allows for interaction with RESTful web services.
- REST stands for representational state transfer and was created by computer scientist Roy Fielding.
- When a client request is made via a RESTful API, it transfers a representation of the state of the resource to the requester or endpoint. This information, or representation, is delivered in one of several formats via HTTP
- REST is Stateless, meaning no client information is stored between get requests and each request is separate and unconnected.

REST API


Web Server
REST API
Database
HTTP Request
HTTP Response with JSON/XML/Text
Client

REST API Methods vs. Http Methods



Maven Dependencies

```
<dependency>
	<groupId>org.springframework.boot</groupId>
	<artifactId>spring-boot-starter-web</artifactId>
</dependency>
<!--  To load application automatically after change -->
<dependency>
	<groupId>org.springframework.boot</groupId>
	<artifactId>spring-boot-devtools</artifactId>
	<optional>true</optional>
</dependency>
<
```

Static Resources

Spring Boot will automatically add static web resources located within any of the following directories, which are either in classpath or in root directory of context.

- /META-INF/resources/
- /resources/
- /static/
- /public/

Spring REST

- It is possible to create a RESTful Web Service using @RestController and @RequestMapping annotations.
- Spring uses Jackson JSON library to automatically convert Java classes to JSON.
- Building a rest controller is similar to MVC controller except that it sends JSON and not HTML.
- Annotation @RestController marks the class as a controller where every method returns a domain object instead of a view. It's shorthand for @Controller and @ResponseBody rolled together.

@PathVariable

- A URI Template is a URI-like string, containing one or more variable names Variables are enclosed in {}
- We can use @PathVariable annotation on a method argument to bind it to the value of a URI template variable

```
@GetMapping("/books/{id}")
public String findBook(@PathVariable("id") String bookId)
{
}

@GetMapping(value="/books/{id}/chapters/{chno}")
public String findChapter(@PathVariable("id") String id,
                          @PathVariable("chno") String chno)
{
}
```

@RequestParam

- Annotation which indicates that a method parameter should be bound to a web request parameter.
- If the method parameter is Map<String, String> or MultiValueMap<String, String> and a parameter name is not specified, then the map parameter is populated with all request parameter names and values.
- Optional attributes - defaultValue, name, required
- When defaultValue is provided, it implicitly sets required to false.

```
@GetMapping("/books")
public String findBook(@RequestParam("id") String bookId)
{ }

@GetMapping("/chapter)
public String findChapter(
 @RequestParam(name="id") int id,
 @RequestParam(name="chno", required=false, defaultValue="1")
 int chno)
{}
```

Spring HTTP Message Converters

- Message converters convert object to the required format.
- These message converters need extra libraries like Jackson JSON to be in classpath to work.

Spring HTTP Message Converters

- If the client's request has Accept header set to application/json then if Jackson JSON library is in the application's classpath, the object returned from the handler method is given to MappingJacksonHttpMessageConverter for conversion into a JSON representation to be returned to the client.
- On the other hand, if the request header indicates that the client prefers text/xml, then Jaxb2RootElementHttpMessageConverter is tasked with producing an XML response to the client.

Request Mapping Annotations

These are HTTP method specific shortcut variants of @RequestMapping:

- ✓ **@GetMapping**
- ✓ **@PostMapping**
- ✓ **@PutMapping**
- ✓ **@DeleteMapping**

Request Mapping Annotations

```
@RestController
@RequestMapping("/persons")
class PersonController {
        @GetMapping("/{id}")
        public Person getPerson(@PathVariable Long id) {
            // ...
        }

        @PostMapping
        @ResponseStatus(HttpStatus.CREATED)
        public void add(@RequestBody Person person) {
            // ...
        }
}
```

RestController Example

```
@RestController
@RequestMapping(value = "/api/jobs")
public class JobsRestController {
   @Autowired
   private JobRepository jobRepo;
```

Http Response Codes

Code	Meaning
200	Ok
201	Created
204	No Content
400	Bad Request
401	Unauthorized (unauthenticated)
403	Forbidden
404	Not Found
405	Method not allowed
500	Internal server error

ResponseStatusException

- When a method in REST API throws this exception, it indicates some error.
- We can create an instance of it providing an ***HttpStatus*** and optionally a *reason* for error.

```
ResponseStatusException(HttpStatus status)

ResponseStatusException
   (HttpStatus status, String reason)

ResponseStatusException
  (HttpStatus status, String reason, Throwable cause )
```

```
new ResponseStatusException
    (HttpStatus.NOT_FOUND, "Product Id Not Found");
```

HttpStatus Constants

ACCEPTED	202 Accepted.
BAD_REQUEST	400 Bad Request.
CREATED	201 Created.
FORBIDDEN	403 Forbidden.
INTERNAL_SERVER_ERROR	500 Internal Server Error.
METHOD_NOT_ALLOWED	405 Method Not Allowed.
NO_CONTENT	204 No Content.
NOT_FOUND	404 Not Found.
OK	200 OK.
UNAUTHORIZED	401 Unauthorized.

Enabling CORS

- Cross-Origin Resource Sharing (CORS) allows clients such as JavaScript to consume data via REST APIs.
- Often, the host that serves the JS (client) (e.g. client.com) is different from the host that serves the data (REST API) (e.g. api.server.com).
- In such a case, CORS enables cross-domain communication.
- @CrossOrigin annotation is used to enable CORS for a method or all methods of a Class.
- If @CrossOrigin is used with class then CORS is enabled for all methods in the class.
- @CrossOrigin defaults are:
  - ✓ All origins are allowed.
  - ✓ The HTTP methods allowed are those specified in the *@RequestMapping* annotation of the method
  - ✓ The time that the preflight response is cached (*maxAge*) is 30 minutes.

@CrossOrigin Annotation

- **Annotation for permitting cross-origin requests on specific handler classes and/or handler methods.**
- **When applied at the class level, the same @CrossOrigin configuration is applied to all the @RequestMapping methods. If the @CrossOrigin annotation is specified at both the class level and the method level, Spring will derive the CORS configuration by combining attributes from both annotations.**

String allowCredentials

Whether the browser should send credentials, such as cookies along with cross domain requests, to the annotated endpoint.

String[] allowedHeaders

The list of request headers that are permitted in actual requests, possibly "*" to allow all headers.

long maxAge

The maximum age (in seconds) of the cache duration for preflight responses.

RequestMethod[] methods

The list of supported HTTP request methods.

String[] origins

A list of origins for which cross-origin requests are allowed.

@CrossOrigin Example

```
@CrossOrigin(origins = "http://localhost:9999")
@GetMapping("/products")
public List<Product> getProducts()
{
}
```

```
@CrossOrigin(origins = "http://example.com", maxAge = 3600)
@RestController
@RequestMapping("/account")
public class AccountController {
}
```

```
@CrossOrigin
    (origins = {"http://abc.com","http://xyz.com" },
     methods = { RequestMethod.GET,  RequestMethod.POST })
public List<Product> getProducts() {}
```

Enabling CORS in Security Config

- When CORS is enabled for endpoint that are protected with authentication, it is required to disable authentication for pre-flight request.
- In order to disable authentication for pre-flight request, we need to use *cors*() method of *HttpSecurity* object.

```
@Configuration
@EnableMethodSecurity
public class MySecurityConfiguration {
 @Bean
 public SecurityFilterChain filterChain(HttpSecurity http)
   throws Exception {
       http.httpBasic();
       // Enable authentication for all requests
       http.authorizeHttpRequests()
            .anyRequest().authenticated();
       http.csrf().disable();  // needed for post requests
       // required for when authentication is in place
       http.cors();
       return http.build();
    }
}
```

OpenAPI and Swagger

- OpenAPI Specification (formerly Swagger Specification) is an API description format for REST APIs.
- An OpenAPI file allows you to describe your entire API, including:
  - ✓ Available endpoints (/users) and operations on each endpoint (GET /users, POST /users)
  - ✓ Operation parameters Input and output for each operation
  - ✓ Authentication methods
  - ✓ Contact information, license, terms of use and other information.

- Swagger is a set of open-source tools built around the OpenAPI Specification that can help you design, build, document and consume REST APIs.
- Swagger UI – renders OpenAPI definitions as interactive documentation.

Enabling Swagger

- **In order to use Swagger in Spring boot application, we need to add the following dependency.**

```
<dependency>
    <groupId>org.springdoc</groupId>
    <artifactId>springdoc-openapi-starter-webmvc-ui</artifactId>
    <version>2.0.2</version>
</dependency>
```

Using Swagger

- Once project is associated with Swagger UI, it is possible to get information about REST APIs using the following URL:

```
http://localhost:8080/swagger-ui/index.html
```

- It is also possible to get API Docs according to OpenAPI specs in JSON format as follows:

```
http://localhost:8080/v3/api-docs
```

Swagger Annotations

- **The following annotations can be used to provide more information about Endpoints, Parameters and Return values.**

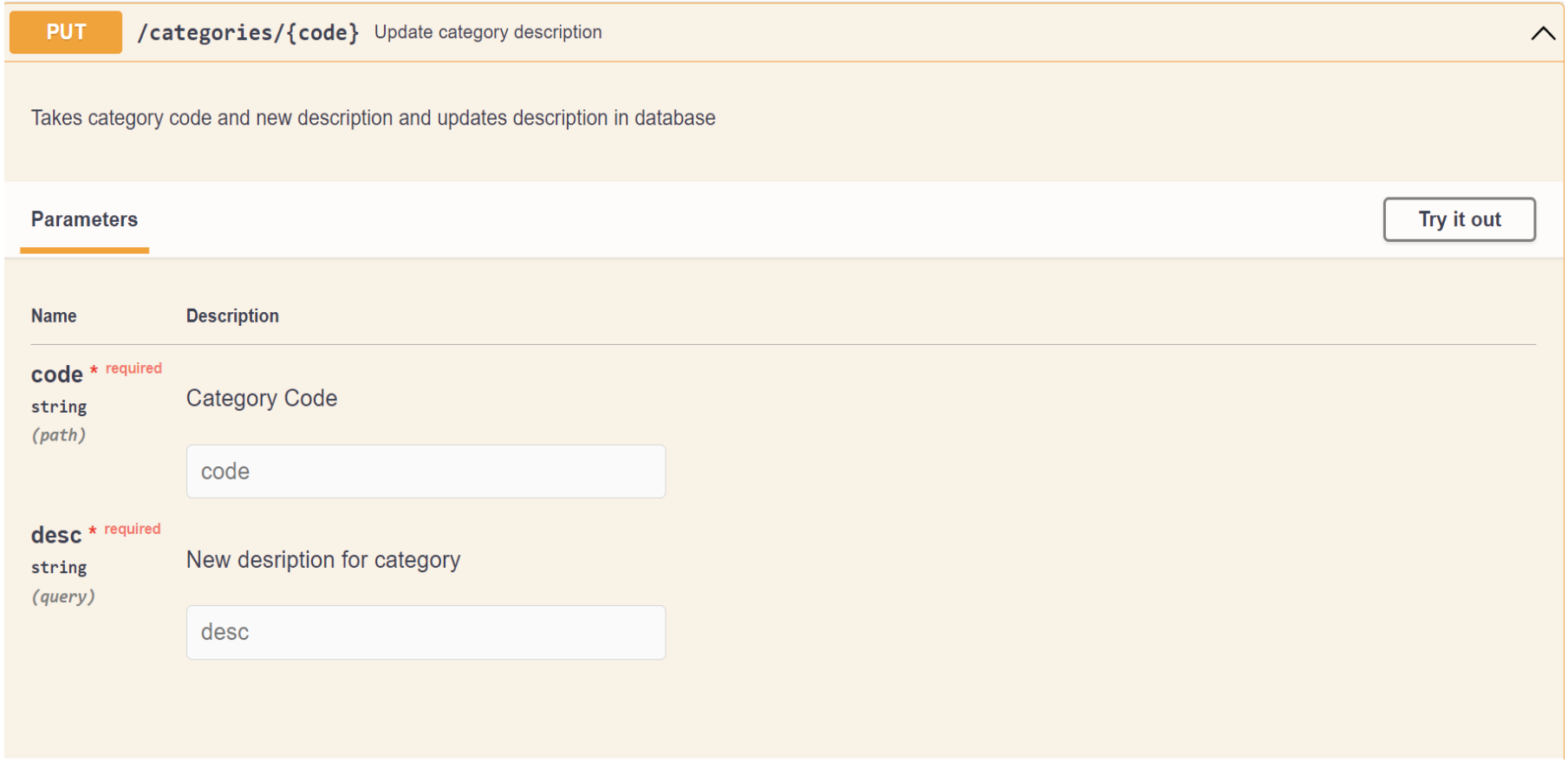
Annotation	Description	Properties
Operation	Describes a method in API.	summary, description, parameters, responses, security, tags
ApiResponses	Provides information about responses.	value
Parameter	Describes parameter	description, required, allowEmptyValue, type, schema
ApiResponse	Specifies details about a single response	responseCode, description

Using Swagger Annotations

```
@PutMapping("/categories/{code}")
@Operation(summary = "Update category description",
description = "Takes category code and new description and updates
description in database")
@ApiResponses(value =
{ @ApiResponse(responseCode = "200",
                description = "Updated category successfully"),
  @ApiResponse(responseCode = "404",
                description = "Category code not found") })
  public Category updateCategoryDesc(
    @Parameter(description = "Category Code")
    @PathVariable("code") String code,
    @Parameter(description = "New desription for category")
    @RequestParam("desc") String desc) {

            // code
}
```

Parameter information



Reponses Information

Responses

Code	Description	Links
200	Updated category successfully Media type */* Controls Accept header. **Example Value** | Schema `{ "code": "string", "description": "string", "products": [ { "id": 0, "name": "string", "price": 0 } ] }`	*No links*
404	Category code not found Media type */* **Example Value** | Schema `{ "code": "string", "description": "string", "products": [ { "id": 0, "name": "string", "price": 0 } ] }`	*No links*