Komunikacja pomiędzy systemami

Usługi sieciowe oparte o protokół Restful Webservices

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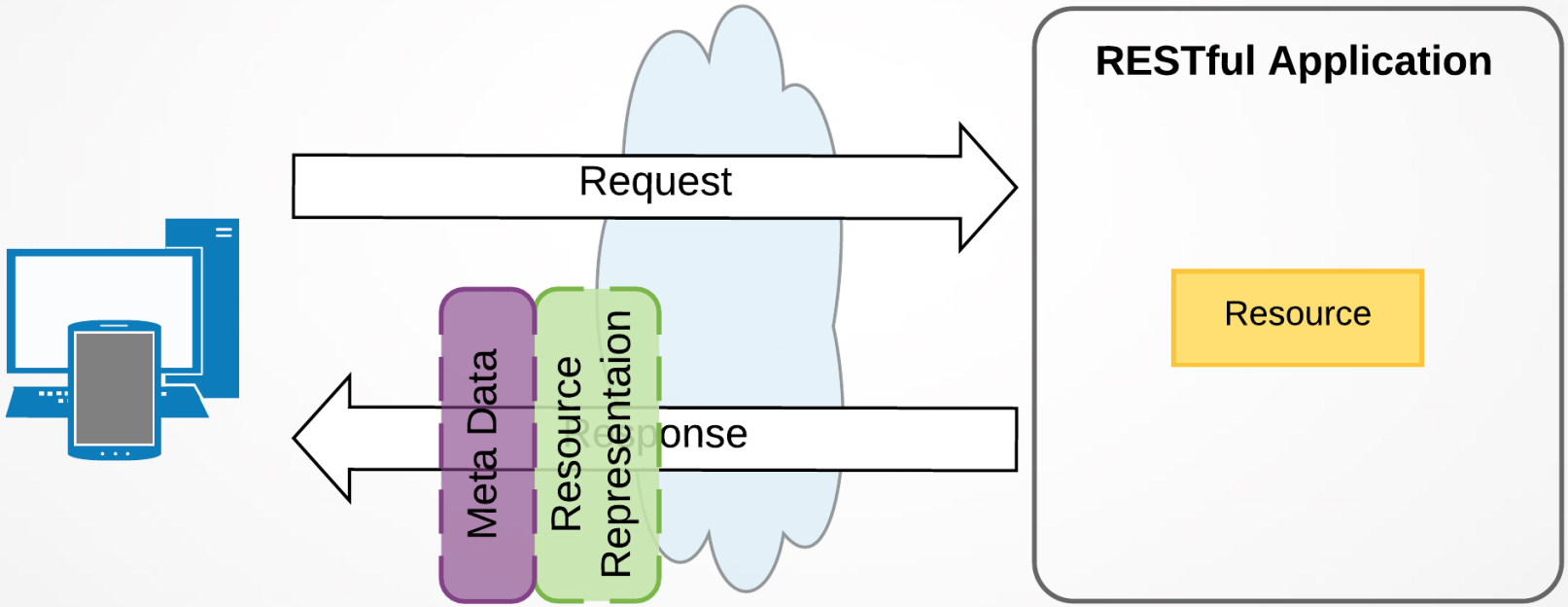
What is REST?

- **R**Epresentational **S**tate **T**ransfer
- Architectural style
- Resource-based
- Goals
  - Visibility
  - Reliability
  - Scalability
  - Performance
  - Simplicity (more reliable)
  - Portability
  - Modifiability

REST - an architectural style



REST – constraints

- Client-server architecture
- Statelessness
- Cacheability
- Layered system
- Uniform interface
  - Resource identification in requests
  - Resource manipulation through representations
  - Self-descriptive messages
  - Hypermedia as the engine of application state (HATEOAS)
- Code on demand (optional)

Uniform Interface - Http

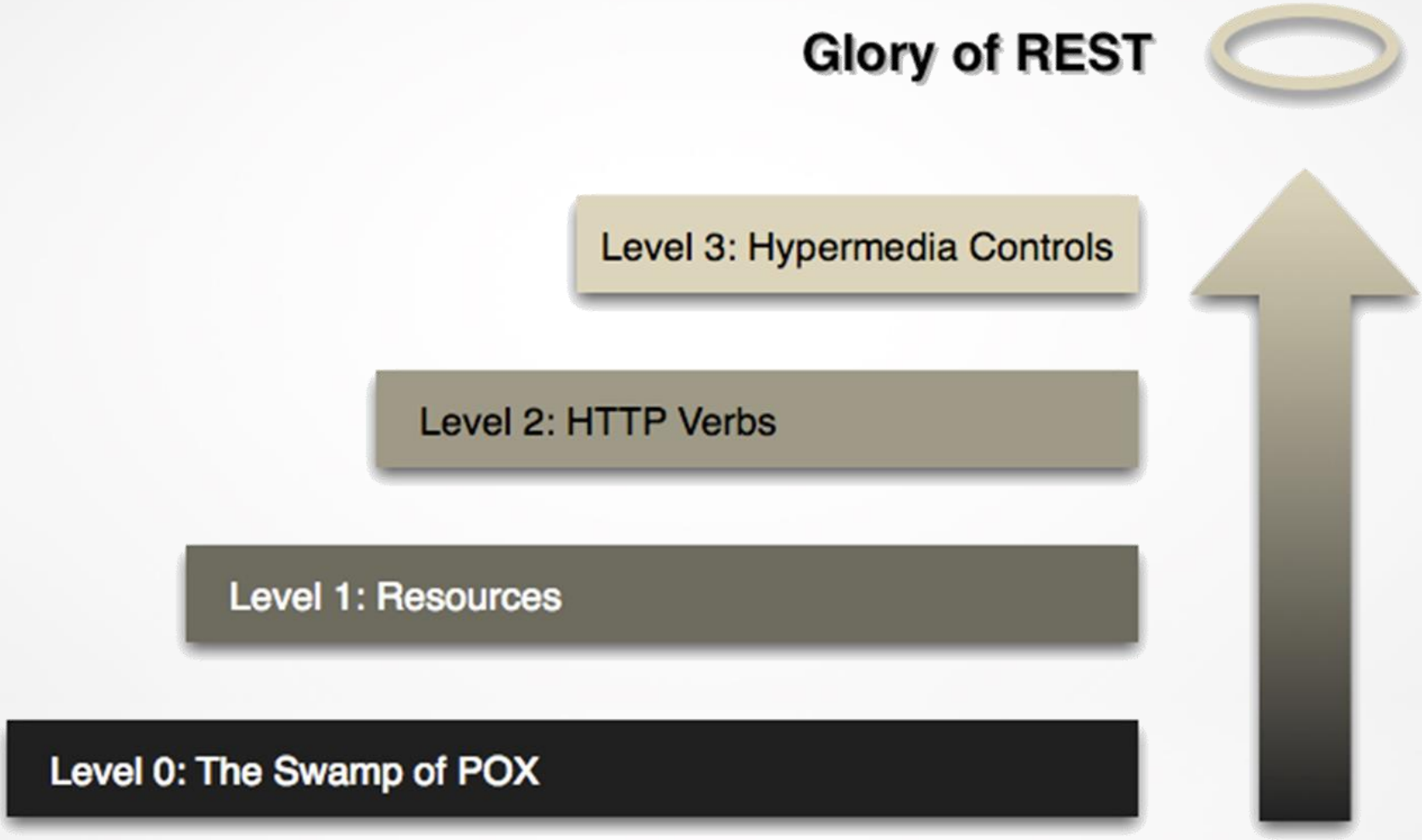
- HTTP methods
  - `OPTIONS, GET, HEAD, TRACE, PUT, DELETE, POST`

Method	Safe	Idempotent	Cacheable
GET	Yes	Yes	Yes
PUT	No	Yes	No
DELETE	No	Yes	No
POST	No	No	Yes
PATCH	No	No	No

Self-descriptive message – HTTP status codes

- **1xx** (Informational)
  - Communicates transfer protocol-level information
- **2xx** (Success)
  - The action requested by the client was received, understood and accepted
  - `200` (OK), `201` (Created), `202` (Accepted), `204` (No Content)
- **3xx** (Redirection)
  - The client must take additional action to complete the request
  - `301` (Moved Permanently), `303` (See Other), `304` (Not Modified), `307` (Temporary Redirect)
- **4xx** (Client errors)
  - The error seems to have been caused by the client
  - `400` (Bad Request), `401` (Unauthorized), `403` (Forbidden), `404` (Not Found), `409` (Conflict)
- **5xx** (Server errors)
  - The server is aware that it has erred or is incapable of performing the request
  - `500` (Internal Server Error), `503` (Service Unaviable)

Richardson Maturity Model



https://martinfowler.com/articles/richardsonMaturityModel.html

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REST implementation - JAX-RS 2.1

- Java API for RESTful Web Services
- API specification
- Goals
  - POJO-based
  - HTTP-centric
  - Format independence
  - Container independence
  - Inclusion in Java EE
- Implementations
  - Jersey (Reference)
  - RestEasy
  - Apache CXF

Uniform interface - JAX-RS

- Resource identification in requests
  - `@ApplicationPath, @Path, @PathParam, @QueryParam`
  - `@GET, @POST, @PUT, @DELETE, @HEAD, @OPTIONS, @PATCH`
- Resource manipulation through representations
  - `@Consumes`
- Self-descriptive messages
  - `@Produces`
  - http response code (2xx, 3xx, 4xx, 5xx)
- Hypermedia as the engine of application state (HATEOAS)
  - `javax.ws.rs.core.Link`

REST implementation – Spring Boot 5.0

- Spring Boot provides a good platform for Java developers to develop a stand-alone and production-grade application
- Goals
  - To avoid complex XML configuration in Spring
  - To develop a production ready applications in an easier way
  - To reduce the development time and run the application independently
  - Offer an easier way of getting started with the application (*SpringInitalizr*)
- Includes Embedded Servlet Container (Apache Tomcat) for stand-alone applications (*.jar*) but may be packaged as a *.war*

Uniform interface - Spring Boot 5.0

- Resource identification in requests
  - `@RestController, @RequestMapping, @GetMapping, @PostMapping , @PutMapping , @DeleteMapping, @RequestBody, @ResponseBody, @PathVariable, @RequestParam`
- Resource manipulation through representations
  - `@RequestMapping(consumes = „...”)`
- Self-descriptive messages
  - `@RequestMapping(produces = ”...”)`
  - http response code (2xx, 3xx, 4xx, 5xx)
- Hypermedia as the engine of application state (HATEOAS)
  - `org.springframework.hateoas.Link`

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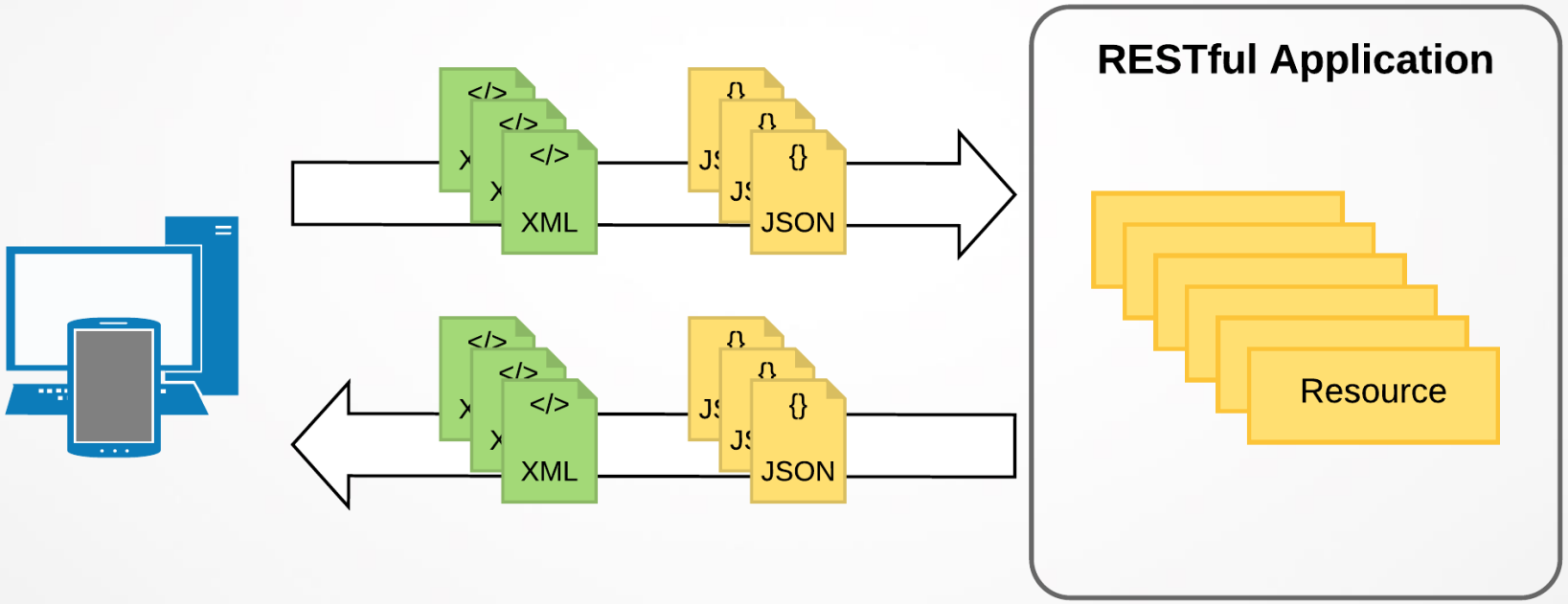
JAX-RS vs. Spring Boot

Spring Annotation	JAX-RS Annotation
n/a	@ApplicationPath("/api")
@RequestMapping(path = "/surveys")	@Path("/surveys")
@RequestMapping(method = RequestMethod.GET)	@GET
@PostMapping	@POST
@DeleteMapping	@DELETE
@RequestBody	n/a
@ResponseBody	n/a
@PathVariable("id")	@PathParam("id")
@RequestParam("lang")	@QueryParam("lang")
@RequestParam(value="name")	@FormParam("name")
@RequestMapping(consumes = {"text/xml"})	@Consumes("text/xml")
@RequestMapping(produces = {"text/xml"})	@Produces("text/xml")

Data binding



Java Architecture for XML Binding (JAXB) 2.2

- Is a Java standard (JSR 31, JSR 222)
- Provides an API and tools that automate the mapping between XML documents and Java objects
  - Unmarshall (XML to Java)
  - Marshall (Java to XML)
- Binding may be done by
  - generating Java classes from XML Schema (*.xsd*)
  - or annotating POJOs *(javax.xml.bind.annotation*).
- Schema validation
- Implementations
  - Jackson
  - EclipseLink MOXy
  - TopLink (Oracle)

JAXB - Example

```
@XmlRootElement(name = "university", namespace = "pl.fis.lbd2019.jaxrs")
@XmlType(propOrder = {"name", "foundingYear", "rank", "faculties"})
@XmlAccessorType(XmlAccessType.FIELD)
public class UniversityXML
{
  @XmlElement(required = true)
  private String name;

  @XmlElement(name = "founding-year")
  @XmlJavaTypeAdapter(value = LocalDateAdapter.class)
  private LocalDate foundingYear;

  @XmlElementWrapper(name = "faculties")
  @XmlElement(name = "faculty")
  private List<Faculty> faculties;

  @XmlElement(name = "ranking-position")
  private int rank;

  @XmlAttribute
  private boolean verified;

  …
```

JAXB - Example

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<ns2:university
    xmlns:ns2="pl.fis.lbd2019.jaxrs" verified="true">
    <name>FIS University of Technology</name>
    <founding-year>2000-06-13</founding-year>
    <ranking-position>1</ranking-position>
    <faculties>
        <faculty>
            <name>Learning by Doing</name>
            <head-of-department>Prof. Joda</head-of-department>
            <email>joda@fis.pl</email>
            <location>Gliwice</location>
        </faculty>
    </faculties>
</ns2:university>
```

Java API for JSON Binding (JSON-B) 1.0

- Is a Java standard (JSR 367)
- Provides an API that automate the mapping between JSON documents and Java objects
  - serialize (JSON to Java)
  - deserialize (Java to JSON)
- Binding **may** be done/customized by using annotatated POJOs
  - *javax.json.bind.annotation*
  - `@JsonbProperty, @JsonbDateFormat, @JsonbNumberFormat, @JsonbTransient, @JsonbNillable, @JsonbTypeAdapter, @JsonbTypeDeserializer, @JsonbTypeSerializer`
- Naming strategies
- Implementations
  - Eclipse Yasson (reference)
  - Apache Johnzon

JSON-B - Example

```
@JsonbPropertyOrder(value = {"name", "founding-year", "ranking-
position", "faculties"})
public class UniversityJSON
{
  private String name;

  @JsonbProperty("founding-year")
  @JsonbDateFormat("yyyy-MM-dd")
  private LocalDate foundingYear;

  @JsonbProperty("faculties")
  private List<FacultyJSON> faculties;

  @JsonbProperty("ranking-position")
  private int rank;

  private boolean verified;

  ...
```

JSON-B - Example

```
{
    "name": "FIS University of Technology",
    "founding-year": "2000-06-13",
    "ranking-position": 1,
    "faculties": [
        {
            "name": "Learning by Doing",
            "head-of-department": "Prof. Joda",
            "email": "joda@fis.pl",
            "location": "Gliwice"
        }
    ],
    "verified": true
}
```

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Validation – Bean Validation 2.0

- Constraints for JavaBeans
- Validation using API or automatically
  - JAX-RS, SPRING MVC, JPA
- Annotation based
  - Cascade validation `@Valid`
  - `@NotNull, @NotBlank, @Email, @Positive,...`
- Extensble by custom constaints
- Java 8 support
  - Optional
  - Date/Time support

Exception handling – JAX-RS

- `WebApplicationException` - build in exception handled gracefully by the framework
- Provides extension of `WebApplicationException` by a bunch of convenient exceptions for most http error conditions
  - `BadRequestException, NotAuthorizedException, NotFoundException, ...`
- `ExceptionMapper` – global handler which take care of exceptions pointed by the developer. Use `@Provider` to register the mapper.

Exception handling – Spring Boot

- Handling standard MVC exceptions by default exception resolver
  - `BindException, MethodArgumentNotValidException`
  - no control over the body of the response
- Custom exception resolver by extending `AbstractHandlerExceptionResolver`
  - no control over the body of the response
- Annotating business exception with `@ResponseStatus`
  - no control over the body of the response
- On controller level by defining a handler method annotated with `@ExceptionHandler`
  - Full control over the response
- Global handler which take care of exceptions pointed by the developer
  - Full control over the response
  - It makes good use of the newer RESTful `ResposeEntity` response
  - `@ControllerAdvice`

Documentation of RESTful API

- Manually
  - Wiki
  - Word
  - LaTeX
- Generated
  - OpenAPI Specification (Swagger)
  - RESTful API Modeling Language (RAML)
  - RESTful Service Description Language (RSDL)
  - Spring REST Docs
  - SpringRestDoc
  - ApiDocJS

Documentation - Swagger

```
@Api(value = "Restaurant Controller",
  produces = "Provides functionality to operate on simple restaurant")
@RestController
public class RestaurantController
{
  ...

  @ApiOperation(value = "Get restaurant information and its available dishes",
response = RestaurantResource.class)
  @ApiResponses(value = {
    @ApiResponse(code = 200,
      message = "Successfully retrieved restaurant information",
      response = RestaurantResource.class),
    @ApiResponse(code = 404,
      message = "Restaurant not found", response = ErrorResource.class)
    })
    @GetMapping(path = ResourceLink.UriTemplates.RESTAURANT,
      produces = MediaType.APPLICATION_JSON_UTF8_VALUE)
    public RestaurantResource getRestaurant(
        @ApiParam(value = "restaurant identifier", required = true)
        @Valid @NotNull @PathVariable("restaurantId") Long id)
    {
```

Documentation - Swagger

```
@Api(value = "Restaurant Controller",
  produces = "Provides functionality to operate on simple restaurant")
@RestController
public class RestaurantController
{
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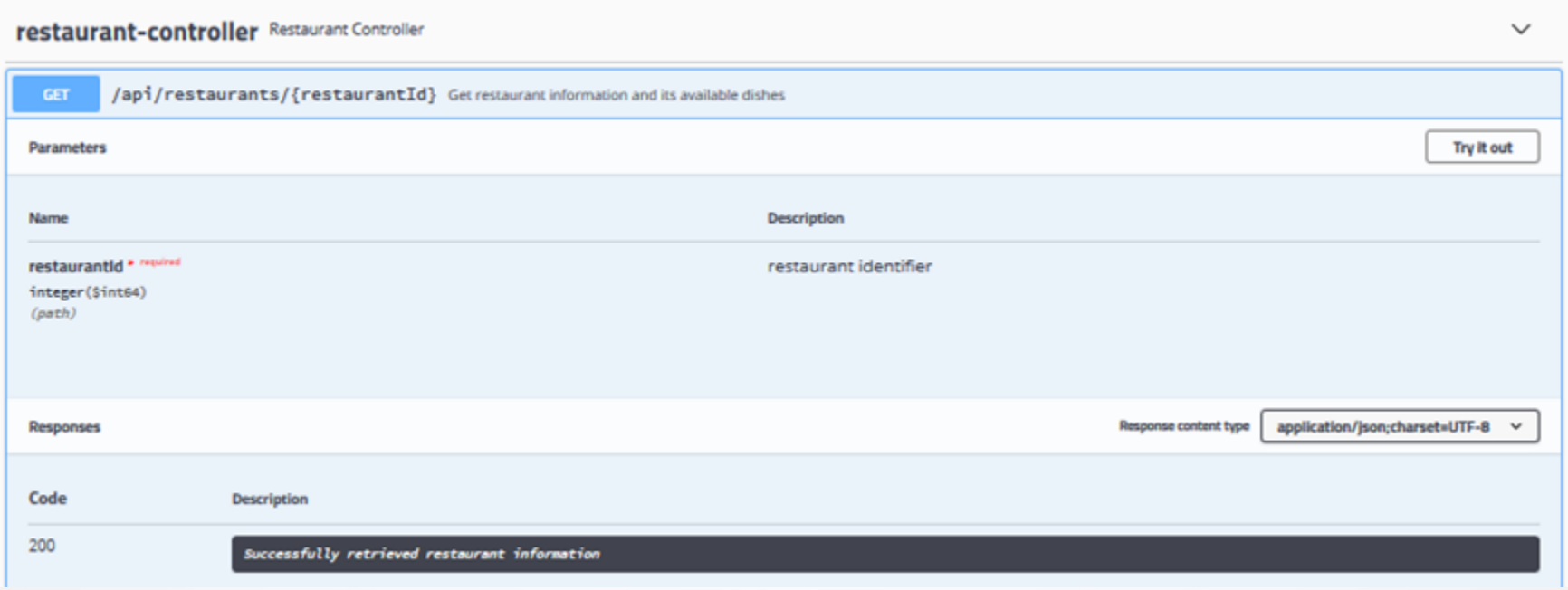

Thank You. Any questions?

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