

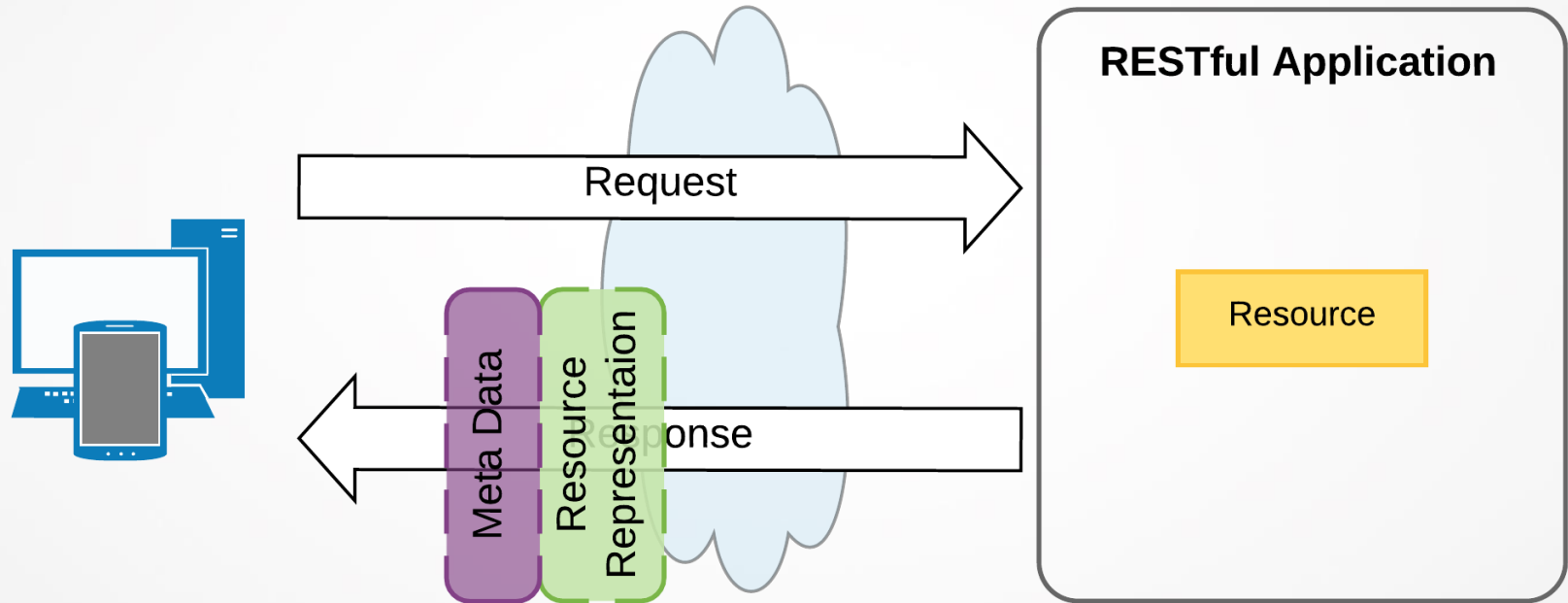
Komunikacja pomiędzy systemami

Usługi sieciowe oparte o protokół Restful Webservices

What is REST?

- **RE**presentational **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 Unavailable)

Richardson Maturity Model

Glory of REST



Level 3: Hypermedia Controls

Level 2: HTTP Verbs

Level 1: Resources

Level 0: The Swamp of POX



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

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*

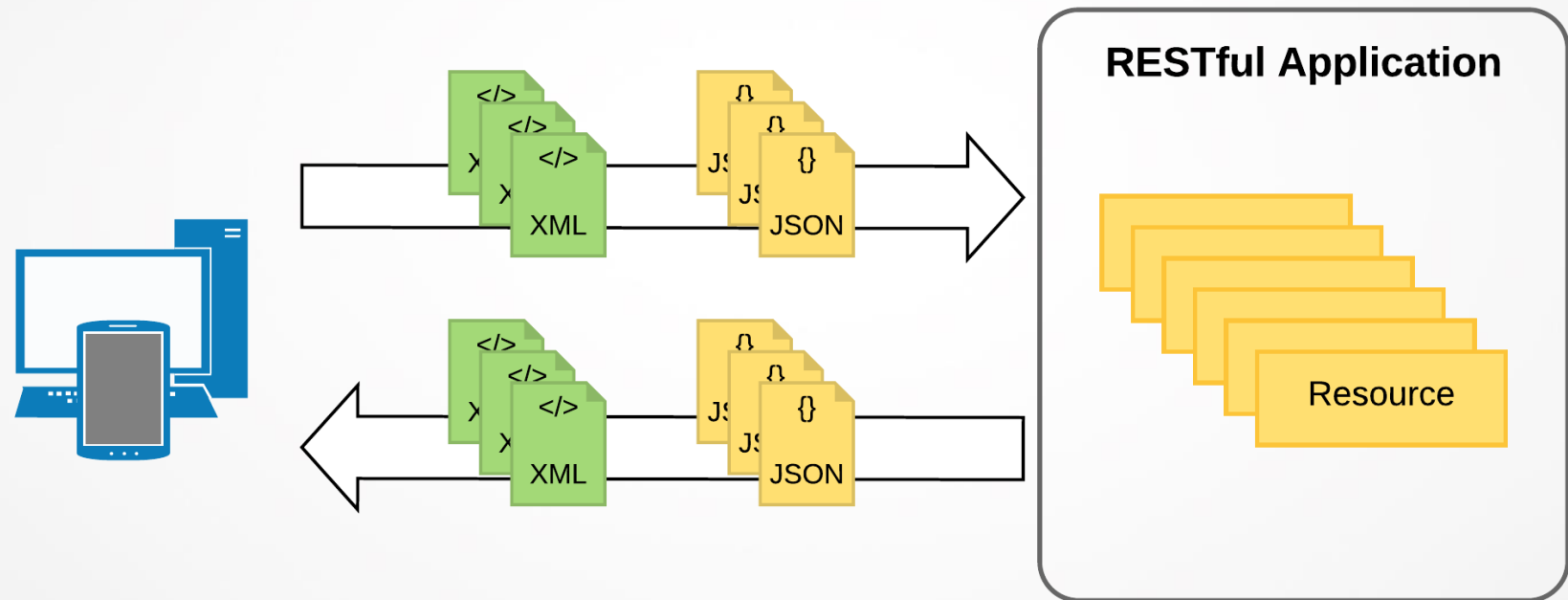
Uniform interface - Spring Boot 5.0

- 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`

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 annotated POJOs
 - *javax.json.bind.annotation*
 - `@JsonbProperty`, `@JsonbDateFormat`, `@JsonbNumberFormat`,
`@JsonbTransient`, `@JsonbNillable`, `@JsonbTypeAdapter`,
`@JsonbTypeDeserializer`, `@JsonbTypeSerializer`
- Naming strategies
- Implementations
 - Eclipse Yasson (reference)
 - Apache Johnzon

JSON-B - Example

```
@JsonPropertyOrder(value = {"name", "founding-year", "ranking-  
position", "faculties"})  
public class UniversityJSON  
{  
    private String name;  
  
    @JsonProperty("founding-year")  
    @JsonDateFormat("yyyy-MM-dd")  
    private LocalDate foundingYear;  
  
    @JsonProperty("faculties")  
    private List<FacultyJSON> faculties;  
  
    @JsonProperty("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  
}
```

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`,...
- Extensible by custom constraints
- 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`, ...
- `ExceptionHandler` – 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 `ResponseEntity` 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
{
    ...

    @ApiOperation(value = "Get restaurant information and its available dishes",
response = RestaurantResource.class)
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    })
    @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

restaurant-controller Restaurant Controller

GET /api/restaurants/{restaurantId} Get restaurant information and its available dishes

Try it out

Name	Description
restaurantId <small>required</small> integer(\$int64) (path)	restaurant identifier

Responses

Response content type application/json;charset=UTF-8

Code	Description
200	Successfully retrieved restaurant information

Thank You. Any questions?



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