REST

WEB SERVICE

Web Service:

A method of communication between two electronic devices over a network
A software function provided at a network address over the web, with the service always on
Used to exchange data

W3C definition of web service:

A software system designed to support interoperable machine-to-machine interaction over a network.

ALTERNATIVES

SOAP

Simple Object Access Protocol
Protocol for sending and receiving messages
XML

WSDL

Web Service Description Language
Model for describing web services
XML

REST

REpresentational State Transfer web service
Architectural style for web resources
JSON

RESTFUL WEB SERVICE

REpresentational State Transfer

Has become one of the most important technologies for web applications
REST Server provides access to resources and REST client accesses and modifies the resources
Resources can be text files, html pages, images, videos or dynamic business data and each resource is identified by URLs
API oriented / Maintainable / Scalable / Light weight communication
HTTP methods are used to extract / manipulate resources: GET, POST, PUT, DELETE

Representational

Clients possess the information necessary to identify, modify, and/or delete a web resource
A resource can consist of other resources
Resources are represented by a format and identified using URLS
Resources can be represented by formats, such as json and xml
Both client and server should be able to comprehend communication format

State

No state information is stored on the server / All state information is stored on the client

Transfer

Client state is passed from the client to the service through HTTP

Architectural constraints

Client-Server

- The clients and the server are separated from each other
- The client is not concerned with the data storage thus the portability of the client code is improved
- The server is not concerned with the client interference, thus the server is simpler and easy to scale

Stateless

- Each request can be treated independently

- REST interactions store no client context on the server between requests
- All information necessary to service the request is contained in the URL, query parameters, body or headers
- The client holds session state

Cacheable

- The responses must define themselves as, cacheable or not, to prevent the client from sending the inappropriate data in response to further requests
- Caching can be controlled using HTTP headers

Uniform interface

- The uniform interface constraint is fundamental to the design of any REST service
- The uniform interface simplifies and decouples the architecture
- Each resource has at least one URI

Layered System (Resources are decoupled from their representation)

- At any time clients cannot tell if they are connected to the end server or to an intermediate
- Neither can clients see (and should not consider), the technologies used to implement a REST API
- When resources are decoupled from their representation their content can be accessed in a variety of formats

REST API URL EXAMPLE

To create a new customer:

GET - HTTP://WWW.EXAMPLE.COM/CUSTOMERS

To create a new customer:

POST - HTTP://WWW.EXAMPLE.COM/CUSTOMERS

To get, update and delete a customer with Customer ID# 33245:

GET - HTTP://WWW.EXAMPLE.COM/CUSTOMERS/33245
PUT - HTTP://WWW.EXAMPLE.COM/CUSTOMERS/33245
DELETE - HTTP://WWW.EXAMPLE.COM/CUSTOMERS/33245

To create a new product:

POST HTTP://WWW.EXAMPLE.COM/PRODUCTS

JAX-RS

JAX-RS stands for JAVA API for RESTful Web Services
JAX-RS is a Java programming language API designed to make it easy to develop applications that use the REST architecture
The JAX-RS API uses Java programming language annotations to simplify the development of RESTful web services
JAX-RS annotations are runtime annotations; therefore, runtime reflection will generate the helper classes and artifacts for the resource

JERSEY

Open source framework for implementing RESTful web services
Consist of components such as core server, core client, JAXB support and JSON support

JAX-RS -> Specification
JERSEY -> Implementation

org.glassfish.jersey.bundles : jaxrs-ri : 2.27

implements JAX-RS 2.1 API

REST IN NETBEANS

1. New maven web application
2. Add dependency org.glassfish.jersey.bundles : jaxrs-ri
3. Create new package rest
4. Create new restful web service from pattern (Simple root resource -> application/json)

APPLICATIONCONFIG

Automatically updated with resource classes when adding new restful web services

ApplicationPath (Where to access server root REST API)

ANNOTATIONS

Annotations are used in the restful web service to configure the communication between server and client.

ApplicationPath (Server root REST API path)

```
@javax.ws.rs.ApplicationPath("api")
```

Path (Resource path) - Can be used both on complete class and individual methods

```
@Path("person/all")
```

Get / Post/ Put / Delete (HTTP method used)

```
@GET / @POST / @PUT / @DELETE
```

Produces / Consumes (Body type: JSON / XML / HTML)

MediaType.APPLICATION_JSON / MediaType.APPLICATION_XML / MediaType.TEXT_HTML

```
@Consumes(MediaType.APPLICATION_JSON)
@Produces(MediaType.APPLICATION_JSON)
```

PathParam (Path parameters)

```
@Path("all/{id}")
@PathParam("id") int id
```

QueryParam (Query parameters)

```
?job=None
@QueryParam("p1") String job
```

DefaultValue (Default values if missing)

```
@DefaultValue("Nothing")
```

Context

```
@Context
private UriInfo uriInfo;
                System.out.println(uriInfo.getQueryParameters().toString());
                System.out.println(uriInfo.getQueryParameters().get("p1"));
@Context
private HttpHeaders httpHeaders
                System.out.println(httpHeaders.getMediaType());
SecurityContext / Request / …
```

Content (json / body)

```
@POST
@Consumes(MediaType.APPLICATION_JSON)
public void postJson(String json) { System.out.println(json) }
```

Response

```
return Response.ok("{}").build();
return Response.status(Response.Status.ACCEPTED).entity("{}").build();
```

JSON

```
{ "name":"John", "age": 31, "member": false, “addresses”:[{“First Road 1”, “New York”},{“Second Road 2”, “Berlin”}] }
```

GSON

When working with REST, there is a need to convert between json strings and java objects
Conversion between Java objects and JSON strings

com.google.code.gson : gson : 2.8.5

GSON IN NETBEANS

1. Add dependency com.google.code.gson : gson

JSON Converting & JSON Parsing

fromJson / toJson / JsonObject / JsonParser / JsonArray

Creating a Gson object

```
Gson gson = new GsonBuilder().setPrettyPrinting().create();
```

Using Gson object

```
gson.fromJson(String);
gson.toJson(Object);
```

From json string to java object (Json property names must match class case sensitive property names)

```
String json1 = "{\"firstName\":\"Ole\",\"lastName\":\"Olsen\",\"phoneNumber\":12345678}";
Person p1 = new Gson().fromJson(json1, Person.class);
```

To json string from java object

```
Person p2 = new Person("Mads", "Madsen", 87654321);
String json2 = new Gson().toJson(p2);
```

Creating a json object

```
JsonObject jo1 = new JsonObject();
Jo1.addProperty("firstName", "Hans");
Jo1.addProperty("lastName", "Hansen");
Jo1.addProperty("phoneNumber", 11223344);
Jo1.addProperty("id", 999);
Person p3 = new Gson().fromJson(jo1, Person.class);
```

Creating a JsonParser object

```
JsonParser jsonParser = new JsonParser();
```

Using JsonParser object

```
JsonObject jo2 = jsonParser.parse(json1).getAsJsonObject();
System.out.println(jo2.has("firstName"));
System.out.println(jo2.has("fName"));
System.out.println(jo2.get("firstName").getAsString());
System.out.println(jo2.get("id").getAsInt());
```

JsonArray to json string

```
JsonArray ja = new JsonArray();
ja.add(jo2);
ja.add(jo3);
String jsonArrayString = new Gson().toJson(ja);
```

Java list to json string

```
ArrayList<Person> Persons = new ArrayList();
Persons.add(p1);
Persons.add(p2);
Persons.add(p3);
String json = new Gson().toJson(Persons);
```

BIDIRECTIONAL RELATIONSHIPS

Person has arraylist / object of type Address AND Address has arraylist / object of type Person

Problem when using objects with bidirectional relationships in new Gson().toJson(object)…

Alternative1: Add transient to reference in entity class

```
private transient List<Address> addresses = new ArrayList();
```

Alternative2: Create DTO class for entity class

Create DTO class with constructor and use typed query to map entity class to DTO class

JPA <-> DTO <-> FACADE <-> REST

Make connection from JPA entities to facades and use the facades in REST web services

POSTMAN

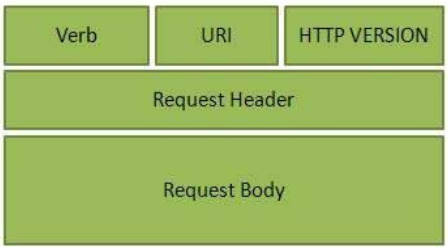
Postman can be used to define and send request to URLs, plus receive and inspect responses

URL / Method / Headers / Body

Responses / Status codes

HTTP

HTTP REQUEST



HTTP Request

- Verb

  Indicate HTTP methods such as GET, POST, DELETE, PUT etc.
- URI

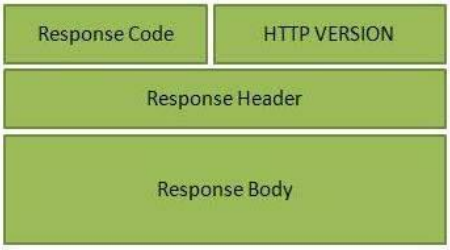
  Uniform Resource Identifier (URI) to identify the resource on server
- HTTP Version

  Indicate HTTP version, for example HTTP v1.1 .
- Request Header

  Contains metadata for the HTTP Request message as key-value pairs. For example, client (or browser) type, format supported by client, format of message body, cache settings etc.
- Request Body

  Message content or Resource representation.

HTTP RESPONSE



HTTP Response

- Status/Response Code

  Indicate Server status for the requested resource. For example 404 means resource not found and 200 means response is ok.
- HTTP Version

  Indicate HTTP version, for example HTTP v1.1 .
- Response Header

Contains metadata for the HTTP Response message as key-value pairs. For example, content length, content type, response date, server type etc.

- Response Body
  Response message content or Resource representation.

HTTP STATUS CODES

SUCCESSFUL
200, OK
201, Created
202, Accepted
204, No Content
205, Reset Content
206, Partial Content

REDIRECTION
301, Moved Permanently
302, Found
303, See Other
304, Not Modified
305, Use Proxy
307, Temporary Redirect

CLIENT_ERROR
400, Bad Request
401, Unauthorized
402, Payment Required
403, Forbidden
404, Not Found
405, Method Not Allowed
406, Not Acceptable
407, Proxy Authentication Required
408, Request Timeout
409, Conflict
410, Gone
411, Length Required
412, Precondition Failed
413, Request Entity Too Large
414, Request-URI Too Long
415, Unsupported Media Type
416, Requested Range Not Satisfiable
417, Expectation Failed

SERVER_ERROR
500, Internal Server Error
501, Not Implemented
502, Bad Gateway
503, Service Unavailable
504, Gateway Timeout
505, HTTP Version Not Supported

TESTING

JUNIT

Add dependencies…
junit : junit 4.12
org.hamcrest : java-hamcrest 2.0.0.0

- Tools -> Create / Update tests
- Set up junit tests

DERBY

In memory database for testing

Add dependency…
org.apache.derby : derby 10.14.2.0

Add persistence unit for testing with subpackage value
<property name="eclipselink.canonicalmodel.subpackage" value="test"/>