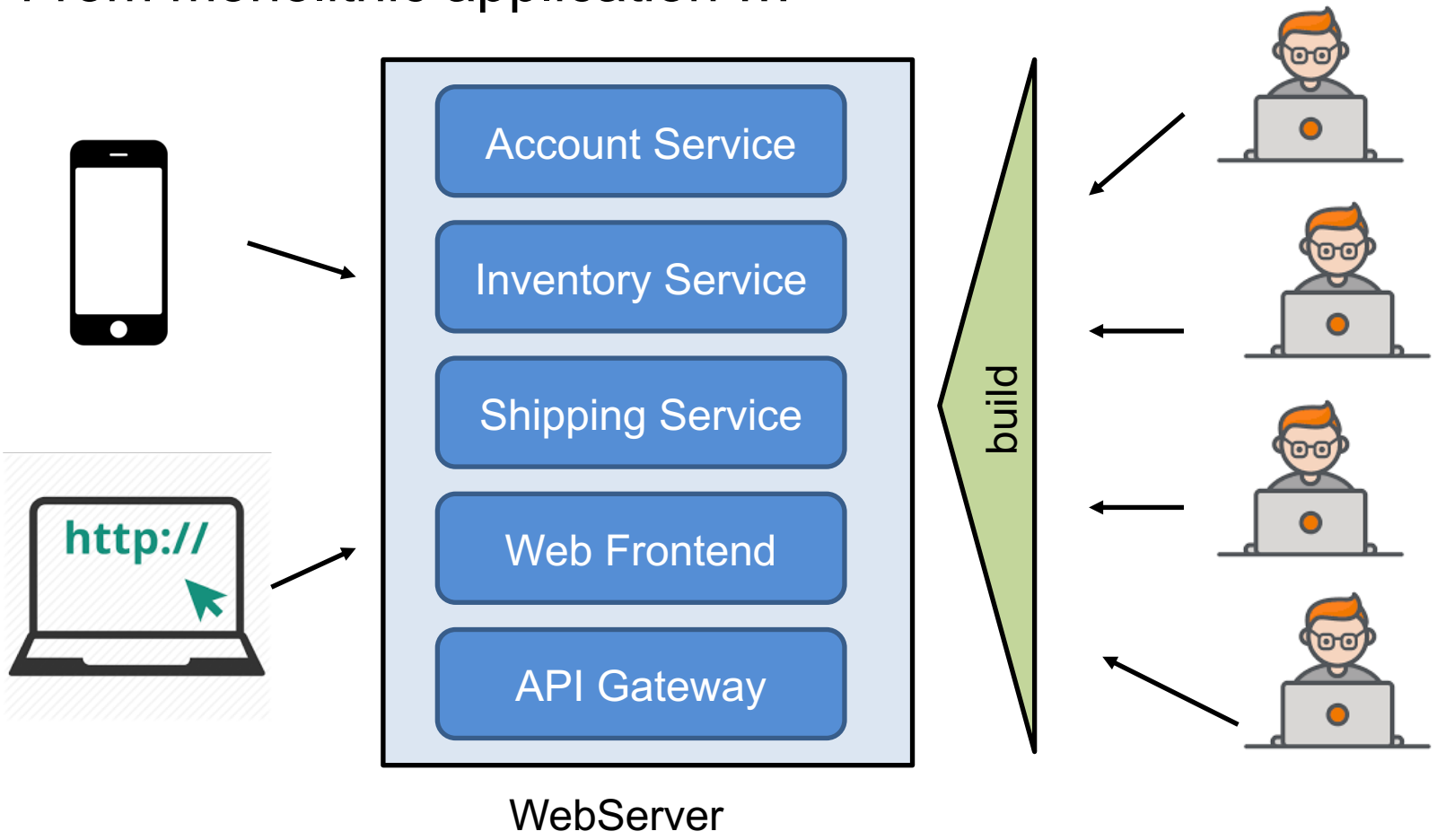
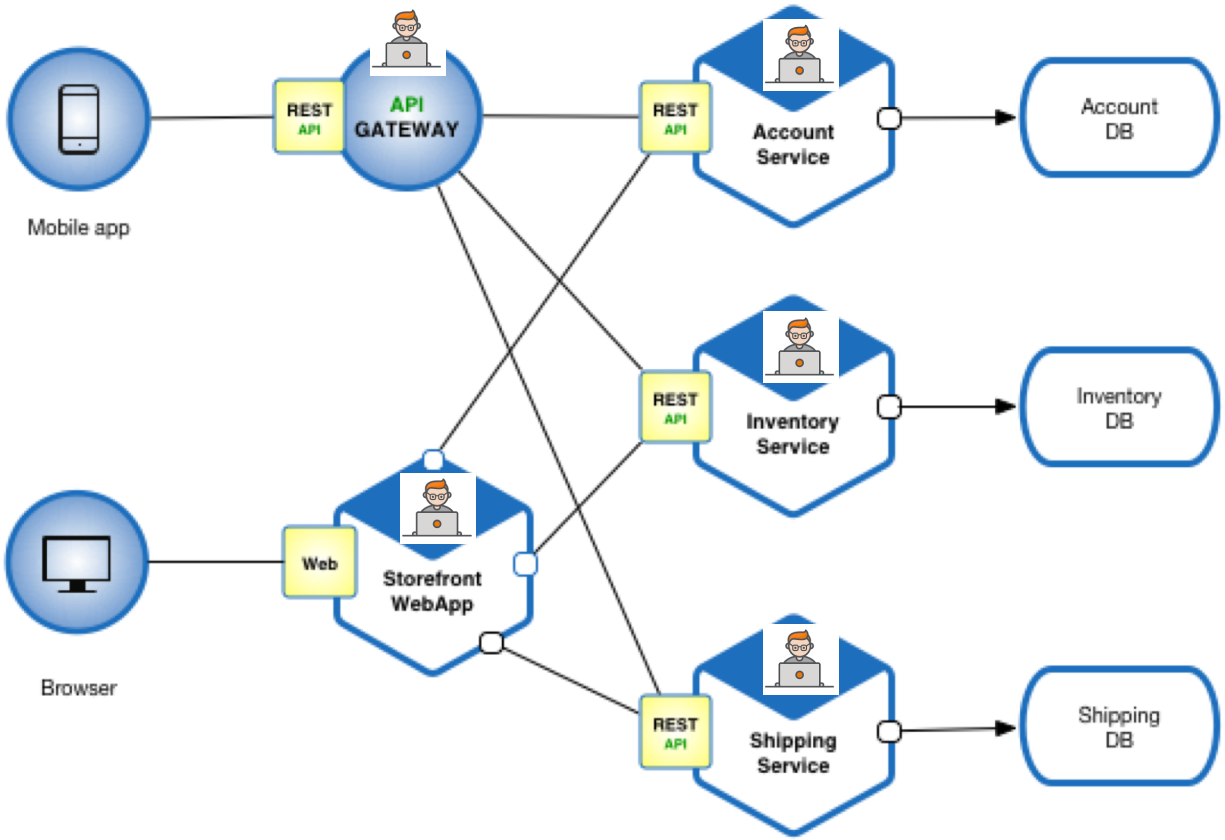
Microservices

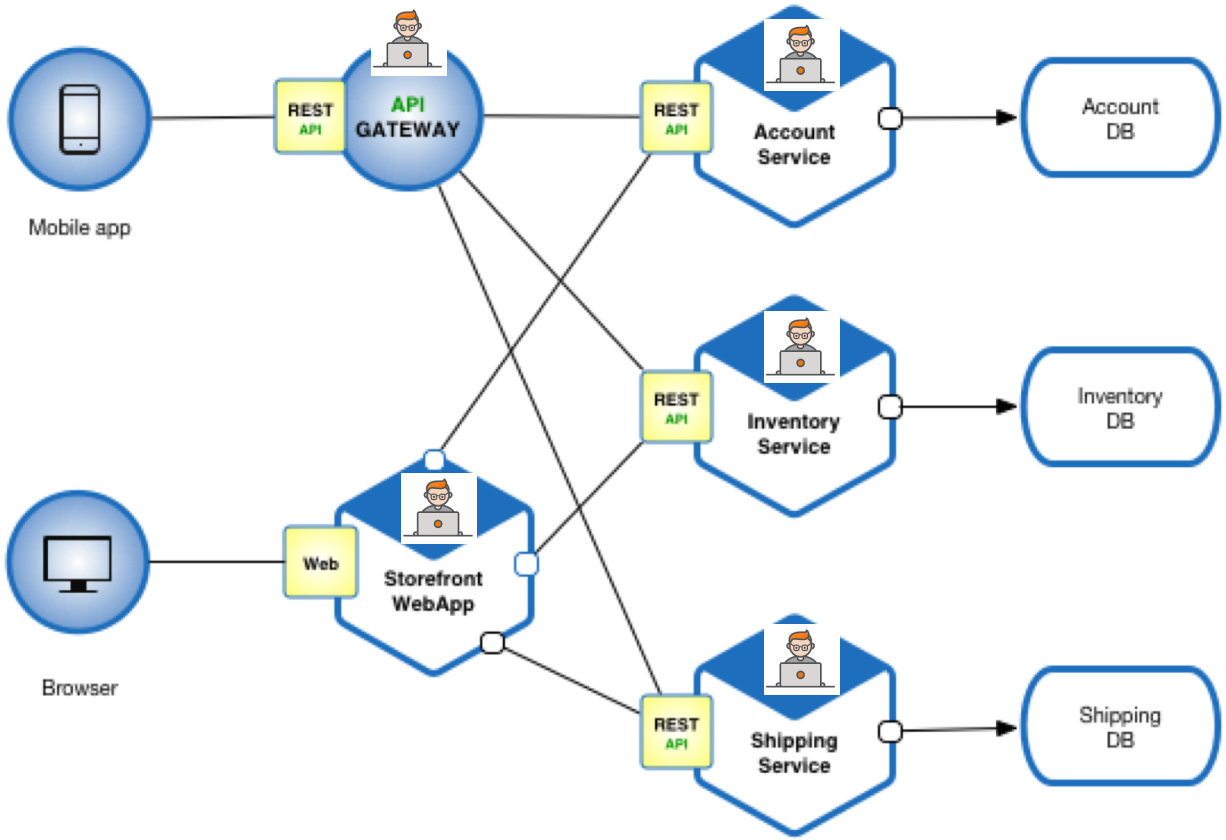
From monolithic application …



… to a collection of (independent) services.

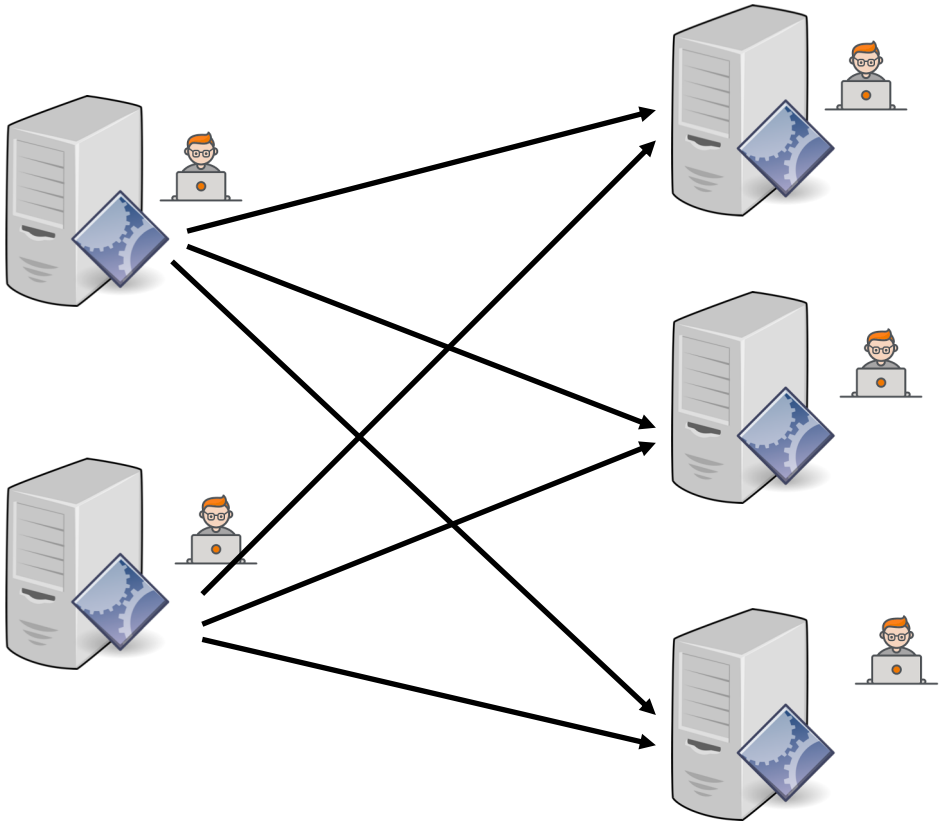


… to a collection of (independent) services.



Modul 14
Microservice

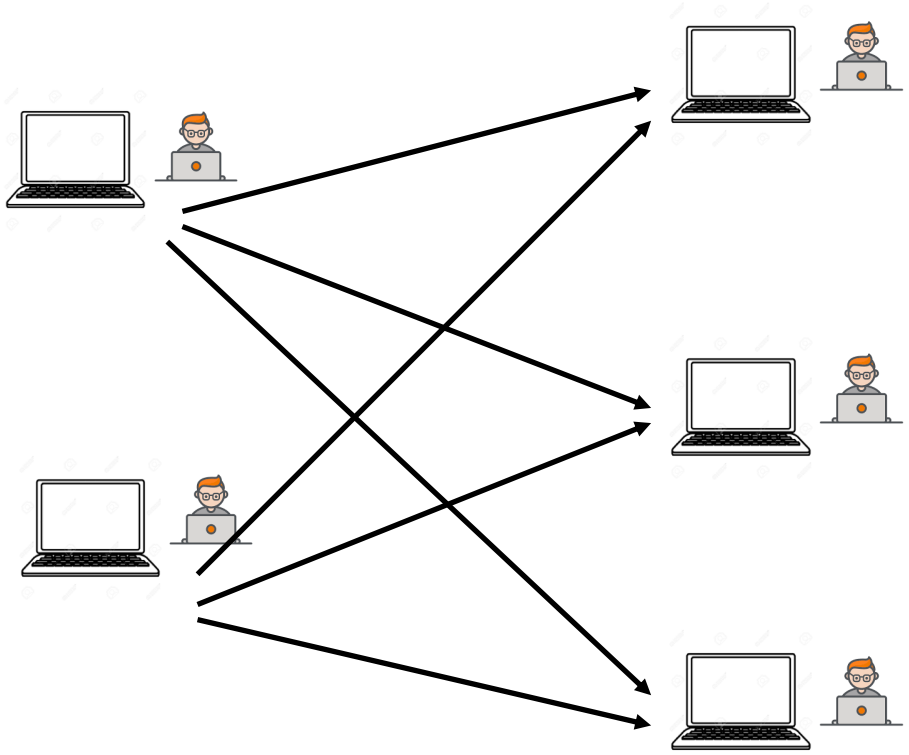
Each service is implemented a as Restful WebService



Problem:
A "big" application server (~400 MB) for each restful webservice is **oversized** … and makes deployment too complex.

Modul 14
Microservice

Solution: Microservice Frameworks (Microprofile 2.x) with small embedded webservers



MICROPROFILE
OPTIMIZING ENTERPRISE JAVA

payara
Payara Micro

Open Liberty

THORNTAIL

Modul 14
Restful with ThornTail (Getting started)

Change defaults

```
<packaging>war</packaging>
```

Properties

```
<properties>
   <version.thorntail>2.4.0.Final</version.thorntail>
   <failOnMissingWebXml>false</failOnMissingWebXml>
</properties>
```

PlugIn

```
<groupId>io.thorntail</groupId>
<artifactId>thorntail-maven-plugin</artifactId>
<version>${version.thorntail}</version>
```

The PlugIn come with the goals **`package`** and **`run`**
`package` generates a *fat*-jar (by default)
`run` starts the application (including the embedded webserver)

Modul 14
Restful with ThornTail (Getting started)

Dependency

```
<dependency>
    <groupId>io.thorntail</groupId>
    <artifactId>jaxrs</artifactId>
    <version>${version.thorntail}</version>
 </dependency>
```

Microprofile is based on JAX-RS (Jersery)

Modul 14
Restful with ThornTail (Getting started)

Create a Java Application with Annotation

```
@ApplicationPath("/myApp")
public class HalloApplication extends Application {
}
```

Create a Rest-Endpoint

```
@Path("")
public class HalloEndPoint {
  @GET
  @Produces("text/plain")
  @Path("/name")
  public String retHallo() {
    return "Hello World!";
  }
```

Test

```
Via CLI: mvn thorntail:run
Im Browser: localhost:8080/myApp/name
```

Modul 14
Restful Endpoints – POST-Example

Example: POST a String, use Jackson ObjectMapper for parsing JSON

```
@POST
@Produces("application/json")
@Consumes("application/json")
@Path("/image")
public String retImg(String body) {
  String imgstr ="???";
  ObjectMapper mapper = new ObjectMapper();
    try {
        JsonNode root = mapper.readTree(body);
        imgstr = root.get("image").asText();
    } catch (IOException ex) {
        Logger.getLogger(CalcImage.class.getName()).
               log(Level.SEVERE, null, ex);
    }
  return "received: " + imgstr ;
}
```

Modul 14
Using the Response-Object

```
public class HalloEndPoint {
  @GET
  @Produces("text/plain")
  @Path("/hi")
  public Response retHallo3() {

    return Response
      .status(Response.Status.OK)
      .entity("Hallo World!")
      .type(MediaType.TEXT_PLAIN)
      .build();
  }
}
```

https://developer.mozilla.org/de/docs/Web/HTTP/Status

Swagger
==
OpenApi

Modul 14
Swagger – OpenAPI Specification

OpenAPI Specification (OAS) == Swagger Specification(old):

- Standard for defining RESTful interfaces

Field Pattern	Type	Description
/{path}	Path Item Object	A relative path to an individual endpoint. The field name MUST begin with a slash. The path is appended to the `basePath` in order to construct the full URL. Path templating is allowed.
^x-	Any	Allows extensions to the Swagger Schema. The field name MUST begin with `x-`, for example, `x-internal-id`. The value can be `null`, a primitive, an array or an object. See Vendor Extensions for further details.

...

OAS 2.0 -> Swagger 1.5.X

OAS 3.0 -> Swagger 2.X

Example

```
public class HalloEndPoint {
  @GET
  @Produces("text/plain")
  @Path("/hi")
  public Response retHallo3() {

    return Response
      .status(Response.Status.OK)
      .entity("Hallo World!")
      .type(MediaType.TEXT_PLAIN)
      .build();
  }
}
```

Modul 14
Swagger – OpenAPI Specification

JSON

```
"/hi": {
     "get": {
       "operationId": "retHallo3",
       "produces": [
         "text/plain"
       ],
       "parameters": [],
       "responses": {
         "default": {
           "description": "successful operation"
         }
       }
     }
   }
```

Modul 14
Swagger – OpenAPI Specification

YAML

```yaml
/hi:
  get:
    operationId: retHallo3
    produces:
      - text/plain
    parameters: []
    responses:
      default:
        description: successful operation
```

Modul 14
Swagger – OpenAPI Specification

Example

```
@GET
@Produces("text/plain")
@Path("/function/{nr}")
public Response retFuctName(@PathParam("nr") String nr) {
   String str = "";
   if (nr.equals("1") ) str = "OrigImg";
   else if (nr.equals("2") ) str = "GrayScaleImg";
   else str = "error";
   if (str.equals("error")) return
       Response.status(Response.Status.NOT_FOUND).
        entity(str).type(MediaType.TEXT_PLAIN).build();
   else return
        Response.status(Response.Status.OK).
         entity(str).type(MediaType.TEXT_PLAIN).build();
}
```

Modul 14
Swagger – OpenAPI Specification

JSON

```
"/function/{nr}": {
      "get": {
        "operationId": "retFuctName",
        "produces": [
          "text/plain"
        ],
        "parameters": [
          {
            "name": "nr",
            "in": "path",
            "required": true,
            "type": "string"
          }
        ],
        "responses": {
          "default": {
            "description": "successful operation"
          }
        }
      }
```

Modul 14
Swagger – OpenAPI Specification

YAML

```yaml
'/function/{nr}':
  get:
    operationId: retFuctName
    produces:
      - text/plain
    parameters:
      - name: nr
        in: path
        required: true
        type: string
    responses:
      default:
        description: successful operation
```

path == PathParameter
query = QueryParameter

Modul 14
Swagger – OpenAPI Specification

Example

```
@GET
@Produces("text/plain")
@Path("/function/{nr2}/{nr3}")
public Response retFuctName(@QueryParam("nr1") String nr,
       @PathParam("nr2") String n1,
       @PathParam("nr3") String n3) {
    String str = "";
    if (nr.equals("1") ) str = "OrigImg";
    else if (nr.equals("2") ) str = "GrayScaleImg";
    else str = "error";
    if (str.equals("error")) return
            Response.status(Response.Status.NOT_FOUND).
              entity(str).type(MediaType.TEXT_PLAIN).build();
    else return
            Response.status(Response.Status.OK).
              entity(str).type(MediaType.TEXT_PLAIN).build();
}
```

Modul 14
Swagger – OpenAPI Specification

```yaml
'/function/{nr2}/{nr3}':
  get:
    operationId: retFuctName
    produces:
      - text/plain
    parameters:
      - name: nr1
        in: query
        required: false
        type: string
      - name: nr2
        in: path
        required: true
        type: string
      - name: nr3
        in: path
        required: true
        type: string
    responses:
      default:
        description: successful operation
```

Modul 14
Swagger – CodeFirst

Generating OAS From Code

Add Annotions

Generate YAML / JSON

...

Modul 14
Swagger – CodeFirst

For ThornTail add dependency

```
<dependency>
    <groupId>io.thorntail</groupId>
    <artifactId>swagger</artifactId>
    <version>${version.thorntail}</version>
</dependency>
```

Add Annotions to your code …

```
@API( … )
@SwaggerDefinition( … )
@ApiOperation( … )
@ApiResponses( … )
@ApiResponse( … )
```

Modul 14
Swagger – `@API`

@API must be set before each class which defines a Restful endpoint

```
@Api("/myDemo")
@Path("mini")
public class MiniRest {
  @GET
  @Path("/demo")
  public String retName() {
    return "Grabowski";
  }
}
```

Modul 14
Swagger – `@API`

Generated OAS (YAML)

```yaml
/mini/demo:
  get:
    tags:
      - mini
    operationId: retName
    parameters: []
    responses:
      '200':
        description: successful operation
        headers: {}
        schema:
          type: string
```

Modul 14
Swagger – `@SwaggerDefinition( … )`

```
@SwaggerDefinition (
    info = @Info (
        title = "Demo für Swagger",
        description = "A simple example here",
        version = "1.0.0",
        contact = @Contact (
            name = "Hartwig Grabowski",
            email = "hag@web.de",
            url = "https://www.hs-offenburg.de"
        )
    ),
    schemes = {SwaggerDefinition.Scheme.HTTP}
)
```

How to access the restful endpoint (Http or Https)

Modul 14
Swagger – `@SwaggerDefinition( … )`

Generated OAS (YAML)

```yaml
swagger: '2.0'
info:
  description: A simple example here
  version: 1.0.0
  title: Demo für Swagger
  contact:
    name: Hartwig Grabowski
    url: 'https://www.hs-offenburg.de'
    email: hag@web.de
basePath: /myApp
tags:
  [redacted]
  - name: mini
schemes:
  - http
```

Modul 14
Swagger – `@ApiOperation( … )`

```
@GET
    @Produces("text/plain")
    @Path("/stud1")
    @ApiOperation(
            value = "Retruns a name",
            notes = "Only surname")
    public String retName1() {
        return "Grabowski";
    }
```

Modul 14
Swagger – `@ApiOperation( … )`

```
/stud1:
  get:
    summary: Retruns a name
    description: Only surname
    operationId: retName1
    produces:
      - text/plain
    parameters: []
    responses:
      '200':
        description: successful operation
        schema:
          type: string
```

Modul 14
Swagger – `@ApiOperation( … )`

```
@GET
    @Produces("text/plain")
    @Path("/stud2")
    @ApiOperation(
            value = "Retruns a student",
            notes = "JSON of student-object",
            response = Student.class)
    public String retName2() {
        return "... json-of-student-obj ...";
    }
```

```
public class Student {
    String name;
    String matNr;
    // Setter & Getter
}
```

Modul 14
Swagger – `@ApiOperation( … )`

```yaml
/stud2:
  get:
    summary: Retruns a student
    description: JSON of student-object
    operationId: retName2
    produces:
      - text/plain
    parameters: []
    responses:
      '200':
        description: successful operation
        schema:
          $ref: '#/definitions/Student'
```

Modul 14
Swagger – `@ApiOperation( … )`

```
/stud2:
  get:
    summary: Retruns a stud
    description: JSON of st
    operationId: retName2
    produces:
      - text/plain
    parameters: []
    responses:
      '200':
        description: succes
        schema:
          $ref: '#/definitions/Student'
```

```
definitions:
  Student:
    type: object
    properties:
      name:
        type: string
      matNr:
        type: string
```

Modul 14
Swagger – `@ApiOperation( … )`

```
@GET
    @Produces("text/plain")
    @Path("/name")
    @ApiOperation(
      value = "Retruns a list of students",
      notes = "array of JSON of student-object",
      response = Student.class,
      responseContainer = "List")
                          //Only List, Set or Map
    public String retName3() {
      return "… List of json-of-student-obj …";
    }
```

Modul 14
Swagger – `@ApiOperation( … )`

```yaml
/name:
  get:
    summary: Retruns a list of students
    description: array of JSON of student-object
    operationId: retName3
    produces:
      - text/plain
    parameters: []
    responses:
      '200':
        description: successful operation
        schema:
          type: array
          items:
            $ref: '#/definitions/Student'
```

Modul 14
Swagger – `@ApiResponses( … )`

```
@GET
@Produces("text/plain")
@Path("/function/{nr2}/{nr3}")
@ApiResponses(value = {
     @ApiResponse(code = 200, message = "Alles klar"),
     @ApiResponse(code = 404, message = "Nr > 2") })
public Response retFuctName(@QueryParam("nr1") String nr,
                  @PathParam("nr2") String n1,
                  @PathParam("nr3") String n3) {
  String str = ""; …
  if (str.equals("error")) {
     return Response.status(Response.Status.NOT_FOUND).
         entity(str).type(MediaType.TEXT_PLAIN).build();
       } else {
     return Response.status(Response.Status.OK).
          entity(str).type(MediaType.TEXT_PLAIN).build();
       }
    }
```

Modul 14
Swagger – `@ApiResponses( … )`

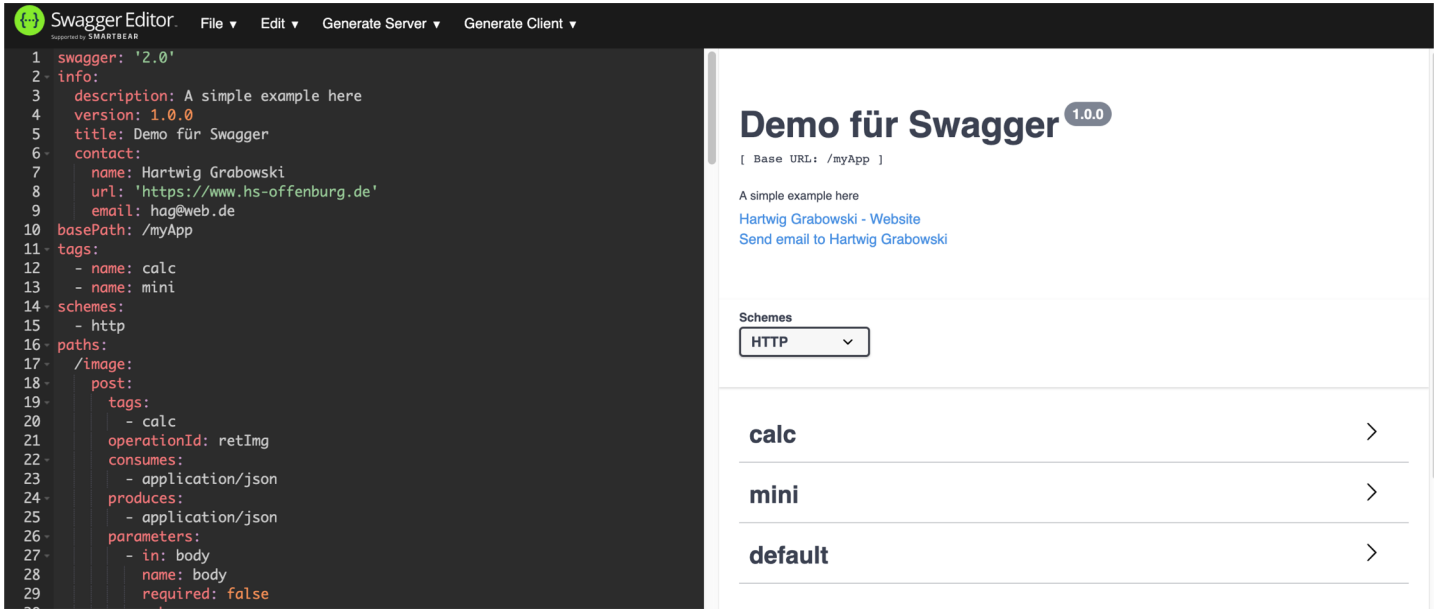
```yaml
'/function/{nr2}/{nr3}':
  get:
    operationId: retFuctName
    produces:
      - text/plain
    parameters:
      - name: nr1
        in: query
        required: false
        type: string
      - name: nr2
        in: path
        required: true
        type: string
      - name: nr3
        in: path
        required: true
        type: string
    responses:
      '200':
        description: Alles klar
      '404':
        description: Falsche Nummer >2
```

Modul 14
Swagger - editor

Swagger-core generates the OAS in JSON under swagger.json (e.g.: http://localhost:8080/myApp/swagger.json)

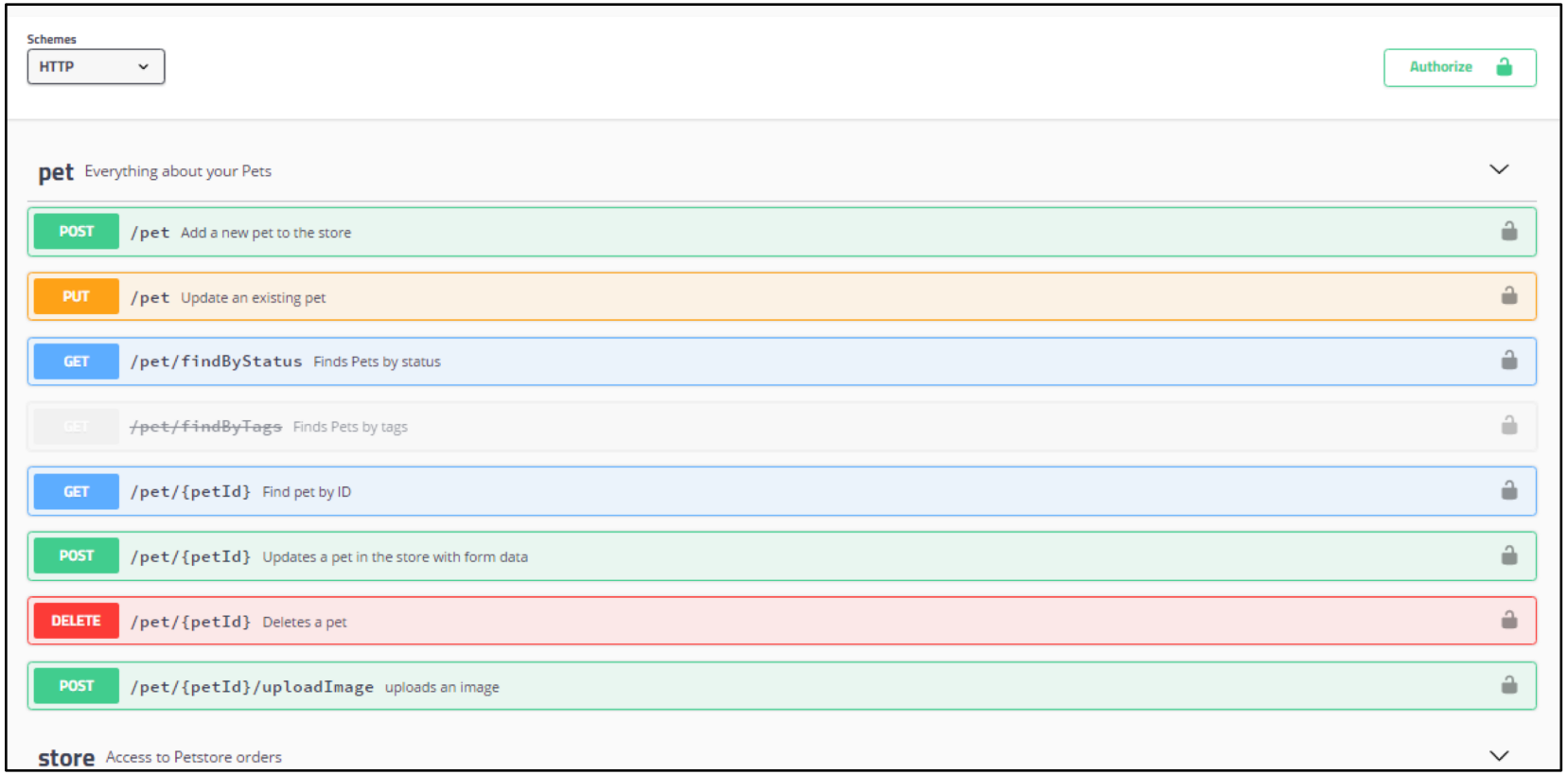
```
{"swagger":"2.0","info":{"description":"A simple example here." ...  }}}}}
```

Copy and paste the content into http://editor.swagger.io/



Modul 14
Swagger – Swagger-UI

Explore and test the generated Restful services

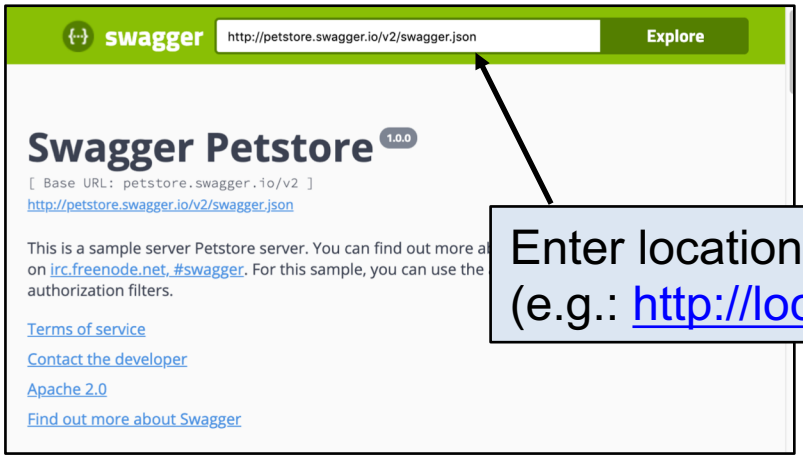


Modul 14
Swagger – Swagger-UI

For ThornTail add dependency

```
<dependency>
    <groupId>io.thorntail</groupId>
    <artifactId>swagger</artifactId>
    <version>${version.thorntail}</version>
</dependency>
```

Build the project and open …
http://localhost:8080/swagger-ui/index.html



Enter location of swagger.json in input filed
(e.g.: http://localhost:8080/myApp/swagger.json)

Modul 14
Swagger – Swagger-UI

Restful services can be tested in the browser