

Property Based API Testing

EDD Workshop Session

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- 1 OpenAPI Basics
- 2 Property-Based-Testing Basics
- 3 Applying PBT to OpenAPI /-Generator
- 4 Questions?

Section 1

OpenAPI Basics

OpenApi: About

- API description language on top of JSON schema
- intended for REST and JSON RPC APIs with JSON or XML payloads
- language independent API specification written in JSON or YML
- plenty of generators and tools for individual language bindings
- client and server adapter generation for models and api

OpenApi: Building Blocks

- General info block (title, license, info, server, tags, ...)
- Operations (HTTP-verb + Path, request and responses, media-types)
- Schemata (named and anonymous models, parameters)
- Security (OAuth 2.0, HTTP BasicAuth, ...)

Swagger Editor

File Edit View Generate Service Generate Client About

```

1  swagger: 3.0.0
2  info:
3    title: Swagger Petstore - OpenAPI 3.0
4    description: |
5      This is a sample Pet Store Server based on the Swagger 3.0 specification. You can find out more about
6      Swagger at [http://swagger.io](http://swagger.io). In the third iteration of the pet store, we've switched to the design first approach!
7      Swagger at [http://swagger.io](http://swagger.io) is the starting point for the definition itself or to the code.
8      That way, with time, we can improve the API in general, and expose some of the new features in OAS3.
9
10   If you're looking for the Swagger 2.0/AS2.0 version of Petstore, then click [here](https://editor.swagger.io/?url=https://petstore.swagger.io/v2/swagger.json). Alternatively, you can load via the Edit > Load Petstore OAS 2.0 menu option.
11
12   Home page: https://petstore.swagger.io
13   The Pet Store repository: https://github.com/swagger-api/swagger-petstore
14   The source API definition for the Pet Store: https://github.com/swagger-api/swagger-petstore/blob/master/src/main/resources/openapi.yaml
15   Terms of Service: http://swagger.io/terms/
16
17   email: apiteam@swagger.io
18   license:
19     name: Apache 2.0
20     url: http://www.apache.org/licenses/LICENSE-2.0.html
21     version: 2.0.0
22     externalDocs:
23       description: Find out more about Swagger
24       url: http://swagger.io
25   servers:
26     - url: https://petstore.swagger.io/v2
27   tags:
28     - name: pet
29       description: Everything about your Pets
30       externalDocs:
31         description: Find out more
32         url: http://swagger.io
33     - name: store
34       description: Access to Petstore orders
35       externalDocs:
36         description: Find out more about our store
37         url: http://swagger.io
38   name: user
39   description: Operations about user
40   paths:
41     /pet:
42       get:
43         description: Get an existing pet
44         summary: Get an existing pet by ID
45         description: Returns an existing pet by ID
46         responses:
47           description: Returns an existing pet to the store
48           content:
49             application/json:
50               schema:
51                 $ref: '#/components/schemas/Pet'
52             application/xml:
53               schema:
54                 $ref: '#/components/schemas/Pet'
55             application/yaml:
56               schema:
57                 $ref: '#/components/schemas/Pet'
58             application/vnd.api+json:
59               schema:
60                 $ref: '#/components/schemas/Pet'
61             application/json-patch+json:
62               schema:
63                 $ref: '#/components/schemas/Pet'
64             application/json-merge-patch:
65               schema:
66                 $ref: '#/components/schemas/Pet'
67             application/json-ext:
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351                $ref: '#/components/schemas/Pet'
352            application/json-ext:
353              schema:
354                $ref: '#/components/schemas/Pet'
355            application/json-ext:
356              schema:

```

Vorbereitung

ERNICommunity GitHub Projekt auschecken:
<https://github.com/ERNICommunity/openapi-workshop>

A1: Modelliere in OpenAPI

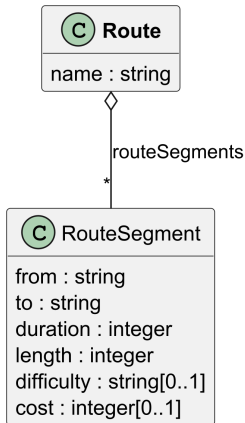


Figure 1: Klassendiagramm für das Modell "Route".

A1: Ausgangslage

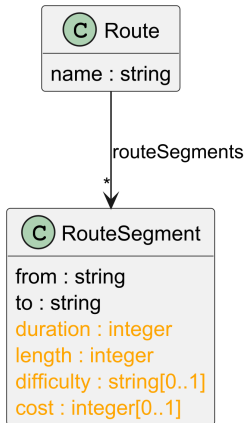


Figure 2: Fehlende “Route”.

A1: 4 “Route”-Attribute hinzufügen

- duration: integer
- length: integer
- difficulty: string[0..1]
- cost: [0..1]

OpenAPI Basics
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Property-Based-Testing Basics
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Applying PBT to OpenAPI /-Generator
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Questions?
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Section 2

Property-Based-Testing Basics

PBT: General



Figure 3: Testing Dilemma: “testing can only find bugs, not prove their absence” (E.W. Dijkstra in [1]).

PBT: Basics

$$\forall i \in I : P(i) = \top, \quad P : I \rightarrow \{\top, \perp\} \quad (1)$$

- I : domain of valid input values (“Eingabedomäne”)
- P : property to prove; candidates include:
 - invariants
 - round-trips
 - symmetry
 - commutativity
 - idempotency
 - induction

[2]

A2: Implementiere PBT isValid()

- using the Arbitraries class, write a jqwik “?” function to define an “Arbitrary” that generates input data (“Testdatengenerator”)
- validate all inputs with openapi4j
- use model Route from previous exercise

Section 3

Applying PBT to OpenAPI /-Generator

Folie 3

A3: Modelliere in OpenApi und prüfe mit PBT

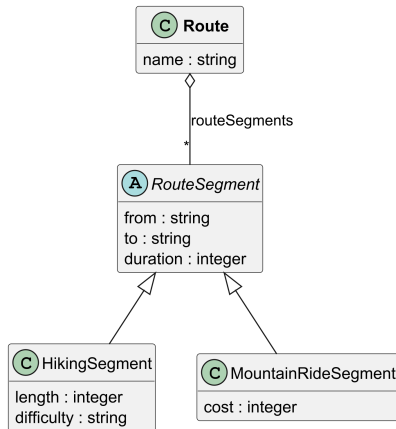


Figure 4: Klassendiagramm für das polymorphe Modell “RouteSegment”.

Section 4

Questions?

References

- [1] P. Godefroid and K. Sen, “Combining model checking and testing,” *Handbook of Model Checking*, pp. 613–649, 2018, Available: https://patricegodefroid.github.io/public_psfiles/mchandbook2018.pdf
- [2] S. Sahayam, “Property-based testing patterns.” Jun. 2016. Available: <https://blog.ssanj.net/posts/2016-06-26-property-based-testing-patterns.html>