Property Based API Testing

EDD Workshop Session

Patrick Pfeiffer Johannes Brügmann

March 6, 2025

1 OpenAPI Basics

2 Property-Based-Testing Basics

3 Applying PBT to OpenAPI /-Generator

Section 1

OpenAPI Basics

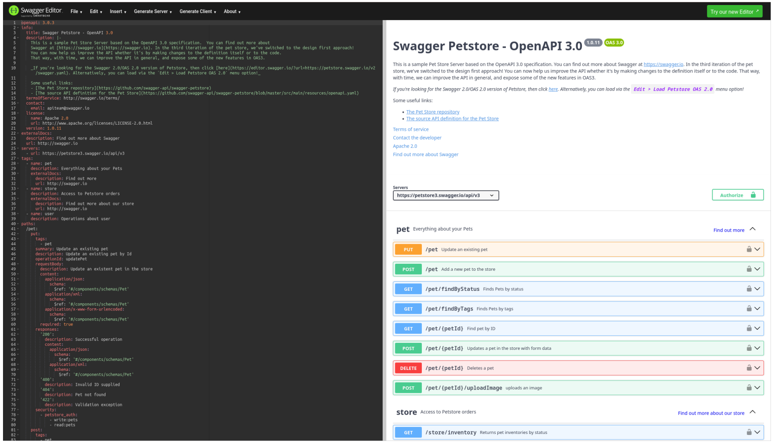
OpenApi: About

- 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 stubs generation for models and api

OpenApi: Building Blocks

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

OpenApi: Swagger Editor



```yaml
openapi: 3.0.3
info:
  title: Swagger Petstore - OpenAPI 3.0
  description: |-
    This is a sample Pet Store Server based on the OpenAPI 3.0 specification.  You can find out more about
    Swagger at [https://swagger.io](https://swagger.io). In the third iteration of the pet store, we've switched to the design first approach!
    You can now help us improve the API whether it's by making changes to the definition itself or to the code.
    That way, with time, we can improve the API in general, and expose some of the new features in OAS3.

    _If you're looking for the Swagger 2.0/OAS 2.0 version of Petstore, then click [here](https://editor.swagger.io/?url=https://petstore.swagger.io/v2
      /swagger.yaml). Alternatively, you can load via the `Edit > Load Petstore OAS 2.0` menu option!_

    Some useful links:
    - [The Pet Store repository](https://github.com/swagger-api/swagger-petstore)
    - [The source API definition for the Pet Store](https://github.com/swagger-api/swagger-petstore/blob/master/src/main/resources/openapi.yaml)
  termsOfService: http://swagger.io/terms/
  contact:
    email: apiteam@swagger.io
  license:
    name: Apache 2.0
    url: http://www.apache.org/licenses/LICENSE-2.0.html
  version: 1.0.11
externalDocs:
  description: Find out more about Swagger
  url: http://swagger.io
servers:
  - url: https://petstore3.swagger.io/api/v3
tags:
  - name: pet
    description: Everything about your Pets
    externalDocs:
      description: Find out more
      url: http://swagger.io
  - name: store
    description: Access to Petstore orders
    externalDocs:
      description: Find out more about our store
      url: http://swagger.io
  - name: user
    description: Operations about user
paths:
  /pet:
    put:
      tags:
        - pet
      summary: Update an existing pet
      description: Update an existing pet by Id
      operationId: updatePet
      requestBody:
        description: Update an existent pet in the store
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/Pet'
          application/xml:
            schema:
              $ref: '#/components/schemas/Pet'
          application/x-www-form-urlencoded:
            schema:
              $ref: '#/components/schemas/Pet'
        required: true
      responses:
        '200':
          description: Successful operation
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/Pet'
            application/xml:
              schema:
                $ref: '#/components/schemas/Pet'
        '400':
          description: Invalid ID supplied
        '404':
          description: Pet not found
        '422':
          description: Validation exception
      security:
        - petstore_auth:
            - write:pets
            - read:pets
    post:
      tags:
        - pet
```

Swagger Petstore - OpenAPI 3.0 1.0.11 OAS 3.0

This is a sample Pet Store Server based on the OpenAPI 3.0 specification. You can find out more about Swagger at https://swagger.io. In the third iteration of the pet store, we've switched to the design first approach! You can now help us improve the API whether it's by making changes to the definition itself or to the code. That way, with time, we can improve the API in general, and expose some of the new features in OAS3.

If you're looking for the Swagger 2.0/OAS 2.0 version of Petstore, then click here. Alternatively, you can load via the `Edit > Load Petstore OAS 2.0` *menu option!*

Some useful links:

- The Pet Store repository
- The source API definition for the Pet Store

Terms of service
Contact the developer
Apache 2.0
Find out more about Swagger

Servers
https://petstore3.swagger.io/api/v3

Authorize

pet Everything about your Pets — Find out more

- PUT /pet Update an existing pet
- POST /pet Add a new pet to the store
- GET /pet/findByStatus Finds Pets by status
- GET /pet/findByTags Finds Pets by tags
- GET /pet/{petId} Find pet by ID
- POST /pet/{petId} Updates a pet in the store with form data
- DELETE /pet/{petId} Deletes a pet
- POST /pet/{petId}/uploadImage uploads an image

store Access to Petstore orders — Find out more about our store

- GET /store/inventory Returns pet inventories by status

Figure 1: Editieren von OpenApi-Dateien in Swagger Editor.

A1: Modelliere in OpenAPI

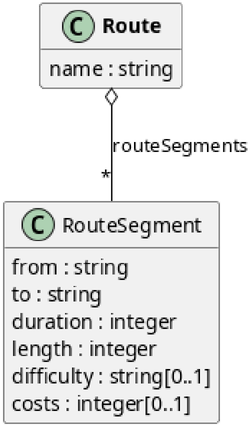


Figure 2: Klassendiagramm für das Modell “Route”.

Section 2

Property-Based-Testing Basics

PBT: Basics

$$\exists P : S \rightarrow \{\top, \bot\} \implies P(s) = \top, \forall s \in S \tag{1}$$

Section 3

Applying PBT to OpenAPI /-Generator

Folie 3