

Semantic Web API Specification

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Thesis Context

The Web is becoming a large repository of open data, available for:

- rich exploratory **querying**
- machine processing such as **generating visualizations**
- **combining multiple data sources**¹

The **Semantic Web**² (Web 3.0) has been designed as a WWW extension that allows computing tools to search, combine and process content that is based on the meaning it has for us.

¹Jacek Kopecký, Paul Fremantle, and Rich Boakes – *A history and future of web apis*

²<http://www.semanticweb.org>

Thesis Statement

Can we augment the existing **Web API Specifications** with **Semantic support** in order to derive both machine and human readable content in a better, more comprehensive way?

Thesis Contribution

Implemented support for **Semantic Augmentation of OpenAPI Specification**³ within **Swagger Editor**⁴ and **Swagger UI**⁵ open source tools.

³<https://swagger.io/specification/>

⁴<https://swagger.io/tools/swagger-editor/>

⁵<https://swagger.io/tools/swagger-ui/>

Augmenting OpenAPI with Semantic Support

Swagger Editor

Swagger UI

Semantic support in Swagger Editor

Added properties for semantic augmentation:

- **x-same-as**
- **x-rdf-type**

Usage:

- **schema-level** — supported value is equivalent to **rdfs:Class**
- **property-level** — supported value is equivalent to **rdf:Property**

Supported values:

- concepts defined in the **Schema.org**⁶ vocabulary

⁶<https://schema.org/>

Semantic support in Swagger Editor

```
components:
  schemas:
    Car:
      type: object
      x-same-as: 'http://schema.org/Vehicle'
      properties:
        emissionsCO2:
          type: 'number'
          x-same-as: 'http://schema.org/emissionsCO2'
      ...
```

Figure 1: Example of augmenting of OAS3 with semantics.

Semantic support in Swagger Editor



- Implemented **suggestions** and **autocomplete support** functionality for the newly added extensions
- Offer **contextual suggestions** and **autocomplete support** for concepts retrieved from **Schema.org**⁷, depending on the location where the extension is used
- Ability to **convert** and **save** an **OpenAPI definition** in **Turtle (TTL)**⁸ **format**

⁷<https://schema.org/>

⁸<https://www.w3.org/TR/turtle/>

Semantic support in Swagger UI

- Associate elements from the **OpenAPI definition** with concepts from the **Schema.org** vocabulary
- Retrieve existing **description** (rdfs:comment) from **Schema.org** for each element that has been augmented with semantics and its inclusion in the generated Swagger UI documentation
- Incorporate **Structured Data** in the generated Swagger UI documentation using **Microdata**⁹

⁹<https://developer.mozilla.org/en-US/docs/Web/HTML/Microdata>  

Demo

Future Directions

Incorporation of Other Ontologies

The **OpenAPI Specification** may be **extended**, enabling the user to incorporate/refer concepts from **other ontologies**.

(e.g. DBpedia¹⁰, Disease Ontology¹¹, Dublin Core¹², etc.)

¹⁰<http://dbpedia.org/ontology/>

¹¹<http://www.disease-ontology.org/>

¹²<http://www.dublincore.org/specifications/dublin-core/>

Publishing resulting Ontology

The addition of a mechanism through which the **ontology** resulted from the Semantic Augmentation is automatically published in a **triplestore**.

(e.g. AllegroGraph¹³, Amazon Neptune¹⁴ Stardog¹⁵, etc.)



This database will entail itself to provide **API recommendations** through the usage of **SPARQL queries** & inference support.

¹³<https://franz.com/agraph/allegrograph/>

¹⁴<https://aws.amazon.com/neptune/>

¹⁵<https://www.stardog.com/>

Self-detection of Semantic Concepts

The creation of a mechanism by which Swagger Editor can **self-detect** what **concepts** are defined in the created **API** and automatically create the associations or provide the user with suggestions from which he can choose the most appropriate one.

Conclusions

- 1 The Semantic Web enables computing tools to do more useful work for us.¹⁶
- 2 We have extended the functionality of the Swagger Editor and Swagger UI open source tools with Semantic support.
- 3 We have created a foundational layer that enables Semantic support and augmentation of OpenAPI definitions.
- 4 Future work can be done by incorporating other ontologies & using triplestore inference capabilities.

Thank you!

¹⁶<https://www.w3.org/standards/semanticweb/>