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Linked Web APIs Dataset

Web APIs meet Linked Data

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Abstract.
Web APIs enjoy significant increase in popularity and usage in the last decade. They have become the core technology for exposing functionalities and data. Nevertheless, due to the lack of semantic Web API descriptions their discovery, sharing, integration, and assessment of their quality and consumption is limited. In this paper, we present the Linked Web APIs dataset, an RDF dataset with semantic descriptions about Web APIs. It provides semantic descriptions for 11,339 Web APIs, 7,415 mashups and 7,717 developers profiles, which makes it the largest available dataset from the Web APIs domain. It captures the provenance, temporal, technical, functional, and non-functional aspects. We describe the Linked Web APIs Ontology, a minimal model which builds on top of several well-known ontologies. The dataset has been interlinked and published according to the Linked Data principles. We describe several possible usage scenarios for the dataset and show its potential.

Keywords: Web APIs, Linked Data, Web services, Linked Web APIs, ontology

1. Introduction

Web APIs have become the first-class citizens on the Web and the core functionality of any Web application. Targeting the developer audience they lower the entry barriers to accessing valuable enterprise data and functionalities. Back in late 2008, ProgrammableWeb.com[1], the largest Web APIs and mashup directory, reported only 1,000 Web APIs, while 5,000 APIs in Feb 2014 and over 13,000 APIs in June 2015. The benefits of having these Web API descriptions provided as Linked Data are several. The Web API descriptions are contextualized, they can be referenced, re-used and combined. The Web APIs data is linked so API consumers can effectively discover new Web APIs. Least but not last, on one side the developers can benefit from a sophisticated queries for discovery and selection of APIs of interest, on the other hand, the Web API providers can execute queries to get better insight and analysis of the Web APIs ecosystem.

To achieve these goals, we have developed the *Linked Web APIs* dataset. It provides information about Web APIs, mashups which utilize Web APIs in compositions, and mashup developers. The primary source for the dataset is ProgrammableWeb.com directory which acts as central repository for Web APIs descriptions. The dataset re-uses several well-known ontologies developed by the Semantic Web community. In order to conform to the Linked Data principles[2] we have also linked the dataset with four central LOD

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[1] http://www.programmableweb.com

[2] http://www.w3.org/DesignIssues/LinkedData.html

datasets: DBpedia[3], Freebase[4], LinkedGeoData[5] and GeoNames[6].

The remainder of this paper is structured as follows. We first, in Section 2 explain the source of information and how the data was collected. Section 3 describes the ontology developed for modelling relevant Web APIs information. Created Linked Web APIs dataset and its technical details are described in Section 4. The approach for interlinking the dataset with other LOD datasets is described in Section 5. Section 6 discusses the quality of the ontology and the dataset. Section 8 discusses related vocabularies and potential data sources. Section 7 presents selected use cases and the results from a survey on the potential and the usefulness of the dataset. Finally, Section 9 concludes the paper.

2. The Data Source

In our work, we have considered ProgrammableWeb as a primary source of information for creating the dataset. It adopts characteristics of a social Web platform where Web API providers can publish and share information about offered Web APIs and consequently increase the visibility of them. The API directory also allows developers to search and find appropriate APIs for their projects, or see and learn from showcases of existing mashup applications.

The implemented knowledge extraction process consists of four steps: (1) parsing and extraction of valuable information from pages describing Web APIs, mashups and developers, (2) pre–processing, cleanup and consolidation of information, (3) linking with LOD resources, and (4) lifting in RDF and publishing the data as Linked Data.

An example of a Web page describing a Web API is the one describing the Twitter API[7]. For each Web API we extracted its title, short summary describing its functionalities, tags and categories assigned, technical information such as supported formats and protocols, as well as non-functional properties such as its homepage, usage limits, usage fees, security, etc. Similarly, for each mashup we extracted its title, short free-text description of its functionalities, assigned tags, and the homepage of the mashup. From each page describing a developer we extracted its username, homepage and short bio about the developer. Also, the city and country of residence, its given and family name and the gender were extracted, if these information were available as public information.

We also captured the *relationships* between the Web APIs, mashups and developers. In other words, for each mashup we extracted the list of Web APIs which were used by the mashup and also the information about the list of mashups created by each developer. The dataset also captures the *temporal aspects* – the creation time of the Web APIs, mashups and the time a user registered his profile.

To collect the data, we have implemented a script which systematically browse relevant pages and parse them. The parsing mechanism has been implemented using the jsoup Java HTML parser[8]. We implemented proper etiquette for the crawler and configured to crawl one page every four seconds.

3. The Ontology

The Linked Web APIs ontology[9] is a minimal model that captures the most relevant information related to Web APIs and mashups. The ontology builds on top of existing and well established ontologies and appropriately extends them. The selection of appropriate ontologies for integration was driven by the following four crucial requirements:

- *Provenance:* It is important to keep information about *Who* (developers) created *What* (mashups) and *How* (using which APIs). What APIs a provider provides also needs to be captured.
- *Functional and Non-functional Properties: What* functionalities a Web API or mashup offers is more than important, as well as their usage limits and fees, supported security or authentication mechanisms.
- *Technical Properties:* Information about the supported protocols and formats and the Web APIs endpoint location is as important, as it allows a Web API consumer to search only for APIs with preferred technical capabilities.

[3] http://dbpedia.org/
[4] https://www.freebase.com/
[5] http://linkedgeodata.org/
[6] http://www.geonames.org/
[7] http://www.programmableweb.com/api/twitter
[8] http://jsoup.org/
[9] http://linked-web-apis.fit.cvut.cz/ns/core/index.html

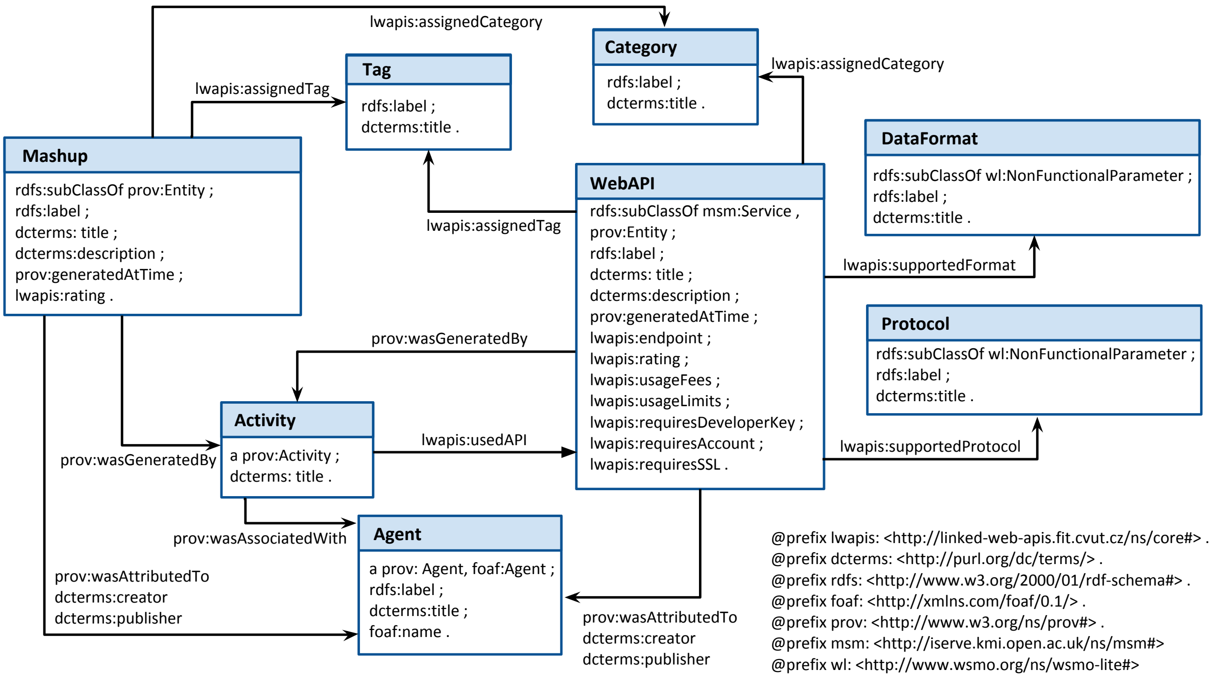

Fig. 1. The Linked Web APIs Ontology.

– *Temporal Information: When* a mashup or Web API was created provides valuable information. For example, to analyze the recent trends in the API ecosystem, or to discover most recent Web APIs or mashups.

Figure 1 shows the overall Linked Web APIs ontology. The ontology contains three central classes: *lso:WebAPI* – to describe Web APIs, *lso:Mashup* – to describe mashup compositions which utilizes one or more Web APIs, and *lso:Agent* – to represents all kinds of entities involved in creation and/or consumption of Web APIs and mashups.

In order to capture the provenance information, the Linked Web APIs ontology integrates the PROV-O ontology[10] by incorporating its classes *prov:Entity*, *prov:Activity* and *prov:Agent*, and their related properties. The *prov:Entity* class serve as super-class of *lso:WebAPI* and *lso:Mashup* classes. Activities convey information about the process of consumption of Web APIs and generation of mashups by the agents. Note that an activity can also refer to an action of creation of API documentation (i.e., ProgrammableWeb entry) and this can be modeled by associating an action with an instance of the *hydra:ApiDocumentation* class from the Hydra[11] vocabulary. We introduce the *lso:usedAPI* property which refines the semantics of the *prov:used* property so it can be used to explicitly identify usage of a Web API in a mashup creation. The temporal information about the time of creation of a mashup or Web API is expressed using the *prov:generatedAtTime* property.

For the functional (tags and categories) and non-functional (formats and protocols) properties of the Web APIs and mashups we introduce new classes in our namespace. The ontology also integrates the *wl:NonFunctionalParameter* class from the WSMO-lite ontology[12] [9], developed by the Semantic Web Services community, to explicitly identify non-functional properties. The Minimal Service Model (MSM) [13] ontology, initially defined for the hRESTS microformat [7] is also considered and the class *msm:Service* is integrated as super-class of the *lso:WebAPI*. This allows to attach additional Web API information, such as operations, inputs and outputs, which is relevant for execution of Web APIs. General metadata information such as Web API and mashup title, or their short tex-

[10] http://www.w3.org/TR/prov-o/

[11] http://www.hydra-cg.com/spec/latest/core/

[12] http://www.wsmo.org/ns/wsmo-lite/

[13] http://iserve.kmi.open.ac.uk/ns/msm#

tual description we describe using the Dublin Core vocabulary[14].

4. The Linked Web APIs Dataset – Coverage, Availability and Maintaince

4.1. Coverage and Availability

The Linked Web APIs is the first Linked Data dataset with Web API descriptions. It provides descriptions for 11,339 Web APIs, 7,415 mashups and 7,717 mashup creators and it contains over 550K RDF triples. For all the resources we mint URIs in our own namespace (`http://linked-web-apis.fit.cvut.cz/resource/{name}`). The `name` part from the URIs is a normalized form of the label of the resource, which is lowercased and each space is replaced with underscore sign. Further, since two different resources can have same name (e.g., the label `XML` can occur as a tag and also as a format) to each minted URI we attach its type as suffix to the URI. For example, `_api` for Web API URIs or `_tag` for tags. An example of a URI minted for the Google Maps API is `http://linked-web-apis.fit.cvut.cz/resource/google-maps_api`. Similar approach is employed by DBpedia and Wikipedia to distinguish between pages which have same title. For example, `/resource/Food_(band)` for a page describing the musical band "Food" and `/resource/Food_(film)` for a page describing the movie with the same name. Possible schema alternative for the URIs would be having the resource type information as a path component (e.g., `/resource/apis/google-maps`). Which URI schema is more appropriate is a debatable question. Nevertheless, both approaches are valid and serve their purpose.

All URIs are dereferenceable and served according the Linked Data principles in RDF/XML and Turtle format. The dataset is also available through a Virtuoso SPARQL endpoint and also as a dump. The landing page for the dataset is `http://linked-web-apis.fit.cvut.cz/` and it provides information about the latest news, releases and changes. Technical details about the dataset are listed in Table 1.

Currently, for the dataset we employ the same versioning approach as the one used by DBpedia – versioning at the dataset level. Nevertheless, versioning at the resource level will be considered in near feature. Versioning at the resource level would be appropriate for integration of the APIs.io repository (see Section 8.2 for more details) since API versioning information is explicitly present.

[14] `http://purl.org/dc/terms/`

Table 1
Details of the Linked Web APIs dataset.

Name	Linked Web APIs dataset
URL	`http://linked-web-apis.fit.cvut.cz/`
Endpoint	`http://linked-web-apis.fit.cvut.cz/sparql`
Ontology	`http://linked-web-apis.fit.cvut.cz/ns/core#`
Version	0.1
Ver. Date	05.08.2015
License	Attribution-NonCommercial-ShareAlike 4.0 International (CC BY-NC-SA 4.0)
Datahub	`https://datahub.io/dataset/linked-web-apis`

4.2. Maintenance and sustainability

The computer center of the Czech Technical University kindly provided us with persistent web space for the publication of the dataset and the ontology. This will guarantee persistent URI identifiers for the dataset resources.

The ongoing maintenance of the dataset is carried out at the data level, as well as at the ontology level and its alignment with relevant existing and emerging vocabularies.

Our long–term goal is to establish the Linked Web APIs as a central Linked Data hub for Web API descriptions. To this end, we aim at providing support for various Web API description models (cf. Section 8.1 and data sources with relevant Web API information (cf. Section 8.2).

5. Dataset Linking

In order to assure maximal reusability and integrability, we linked the dataset with four central LOD datasets. Two multi-domain datasets, DBpedia and Freebase, and two geographical datases GeoNames and LinkedGeoData. From the information we linked the Web APIs supported data formats, supported protocols, developers' city and country of residence. Since GeoNames and LinkedGeoData are geographical datasets, only users' city and country of residence was linked to those datasets. DBpedia and Freebase are multi-domain datasets and therefore we linked all information to these datasets. The links to DBpedia, and respectively to Freebase, were generated following the most-frequent-sense based approach used as entity linking method in Entityclassifier.eu NER system [3]. The linking to LinkedGeoData was governed by the intuition that the names of the cities and countries in our dataset have same names in the LinkedGeoData dataset. The approach was supported by a SPARQL query which retrieves resources with a given label. Following this linking methodology we generated 1,440 links out of which 722 are DBpedia links, 299 Freebase links, 326 GeoNames links and 93 LinkedGeoData links. Table 2 provides more information about the linking.

Table 2
Number of linked resource per type and dataset.

	DBpedia	Freebase	LGD	GeoNames
Formats	283	208	/	/
Protocols	123	91	/	/
Cities	263	/	47	276
Countries	53	/	46	50
Total	722	299	93	326

We opted for these linking approaches, since we have the tooling in place and they served their purpose.

It is important to note that our dataset has also received in–links[15] from DBpedia, the most prominent LOD dataset. The links have been accepted and will be picked up with the new DBpedia release.

6. Quality

According to the 5–star classification system [1] defined by Tim Berners-Lee the Linked Web APIs classifies as five-star dataset. The five stars are credited for the open license, availability in a machine-readable structured format, use of open standards, use of URIs for identification, and the links to the other LOD datasets.

6.1. Dataset Quality

Since the quality of the dataset is primarily dependent on the information extraction process, we have manually evaluated the validity of the created triples. To this end, we have randomly created set of 100 triples and manually checked their validity. Only two invalid triples representing tags have been spotted as invalid. Note that no invalid triples were spotted for the provenance, technical and non–functional information.

[15] `http://downloads.dbpedia.org/2015-10/links/`

6.2. Vocabulary Quality

According to the 5–star vocabulary classification [6] the Linked Web APIs ontology credits four out of five stars: for the machine and human –readable information about the vocabulary (2 stars), it is linked to other vocabularies such as WSMO–lite and PROV–O (3 stars) and metadata information is provided for the vocabulary (4 stars). The fifth star is credited for vocabularies which have been used in linked by by other vocabularies. However, the Linked Web APIs vocabulary has not been yet used and referenced by other vocabularies.

6.3. Known Shortcomings

The information extraction process is not entirely flawless due to its dependency on the HTML structure. From early 2012, when was created our first snapshot of the dataset, until early 2016, the HTML changed only two times, which is approximately every two years. Nevertheless, we are considering also other potential data sources, which will be soon integrated as part of the Linked Web APIs dataset. APIs.io[16] and the mashape marketplace[17] are the two most prominent data sources (see Section 8.2 for discussion on datasources). We are currently working on integration of APIs.io and very soon it will be part of the Linked Web APs dataset.

As for the ontology, some properties such as "usageFees" and "usageLimits" are currently modeled as plain literals. One reason for such decision was the diversity of the possible values of these properties in the data. Also, very often these properties are expressed in human language, thus its modeling is a challenging task. In the future, if a data source provides data of greater quality for these properties, we will appropriately extend the ontology.

7. Usefulness of the Dataset

7.1. Use Cases

The availability of a dataset with Web APIs descriptions in RDF can support various use cases, including, but not limited to personalised Web API provisioning, API ecosystem analysis, and automated processing of

[16] `http://apis.io/`
[17] `https://market.mashape.com/`

Web API descriptions. In this section, we describe selected use cases and existing applications of the Linked Web APIs dataset.

Use case 1: Personalised Recommendations. The Linked Web APIs dataset contains links between the mashups and the developers, which is a pertinent source of information for developing Web API recommendation methods. A simple scenario is when a user has already picked a Web API for his/her mashup and searches for other compatible Web APIs. Such scenario can be supported with the SPARQL query from Listing 1 which returns the top 5 most used Web APIs.

A developer can further customize the query to fit his/her needs, for example, to narrow down the results only to Web APIs which support particular data format (e.g., JSON) or APIs from a specific category (e.g., social, government, etc.).

```
SELECT ?api (COUNT(?api) as ?count)
WHERE {
  ?mashup prov:wasGeneratedBy ?activity.
  ?activity lso:usedAPI ls:google-maps_api .
  ?activity lso:usedAPI ?api .
  FILTER (!strends(str(?api),"google-maps_api"))
}
ORDER BY DESC(?count)
LIMIT 5
```

Listing 1: Top 5 most used Web APIs with Google Maps API.

In the context of personalised recommendations, the dataset has been recently employed in several works around personalised recommendation of Web APIs [4] and Linked Data resources [5]. The papers describe methods which accommodate user preferences by analyzing their history. The method proposed in [5] recommends resources of interest from users with similar tastes. Both works focus on developing graph based algorithms on top of the Linked Web APIs dataset and utilizing the provisioning information (who developed what), functional properties (tags and categories) and temporal information (when a mashup or Web API was developed). The target audience in both methods are ultimately API consumers.

Use case 2: Support for Automated API Discovery, Composition and Orchestration. There are semantic models which provide mechanisms for automated Web service discovery, composition and orchestration. SADI defines such mechanism for fully automated processing and integration of Web services. In such scenarios, the Linked Web APIs dataset can be used as a relevant source to discover Web APIs for a composition workflows. Assuming a user composer already picked her/his favorite API, with query similar to the one in Listing 1 he can retrieve list of candidate APIs. The list of candidate APIs can be further validated and added to the composition workflows.

Use case 3: Temporal Analysis. The dataset also captures the temporal aspect, i.e., the time when a mashup or a Web API was developed. Such information can help Web APIs providers to get better insights about the recent developments and study the consumption of a Web API, or the whole Web API ecosystem over time. The benefits from having temporal information can be illustrated with the SPARQL query from Listing 2.

```
SELECT COUNT(?mashup) as ?count
WHERE {
  ?mashup prov:wasGeneratedBy ?activity.
  ?activity lso:usedAPI ls:google-maps_api .
  ?mashup prov:generatedAtTime ?date .
  FILTER (?date >= "2013-01-01"^^xsd:dateTime
    && ?date < "2014-01-01"^^xsd:dateTime)
}
```

Listing 2: Number of mashups utilizing the Google Maps API in 2013.

The SPARQL query in the listing gives information about the total number of mashups which utilized the Google Maps API in 2013. Figure 2 visualizes the results from such analysis for three popular APIs and their utilization over time.

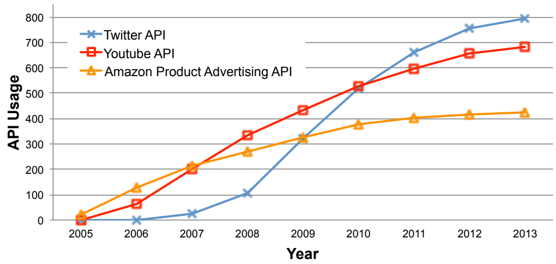

Fig. 2. Web API utilization over time.

The Web API provider might be interested in what kind of mashups their API was used. An answer to such question can be answered with the SPARQL query in Listing 3.

```
SELECT ?category (COUNT(?category) as ?count)
WHERE {
  ?mashup prov:wasGeneratedBy ?activity.
  ?activity lso:usedAPI ls:google-maps_api .
  ?mashup prov:generatedAtTime ?date .
  ?mashup lso:assignedTag ?category .
  FILTER (?date >= "2013-01-01"^^xsd:dateTime
    && ?date < "2014-01-01"^^xsd:dateTime)
} ORDER BY DESC(?count)
```

Listing 3: The number of mashup categories the Google Maps API was used in 2013.

Further, a Web API analyst might be interested in the latest trends in the API ecosystem. Questions such as *"What protocols and formats are the most supported by the APIs?"* or *"Which domains provided most APIs in 2013?"* are likely to occur. Using the SPARQL query in Listing 4 we can get the top 5 most popular protocols in year 2013, which is also illustrated in Figure 3 for the two most used protocols REST and SOAP for a period of ten years.

```
SELECT ?protocol (COUNT(?api) as ?count)
WHERE {
  ?api rdf:type lso:WebAPI .
  ?api prov:generatedAtTime ?date .
  ?api lso:supportedProtocol ?protocol .
  FILTER (?date >= "2013-01-01"^^xsd:dateTime
    && ?date < "2014-01-01"^^xsd:dateTime)
} ORDER BY DESC(?count)
LIMIT 5
```

Listing 4: The most popular API protocols in 2013.

An answer to the question *"Which domains provided most APIs in the 2013?"* can be answered with the SPARQL query in Listing 5. The results show that the most popular API category is "tools", followed by the "science", "internet", "enterprise" and "financial" categories. It is interesting the fact that the "financial" and "enterprise" categories are among the top five most popular API categories, which indicates that APIs are already understood as relevant technology also by other domains than the internet and social networks domain.

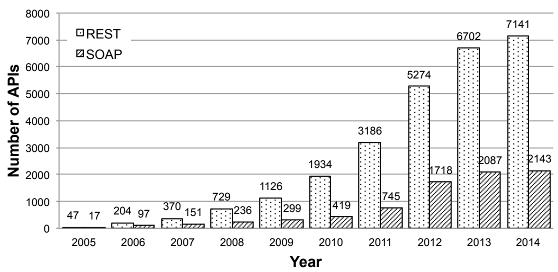

Fig. 3. Popularity of REST and SOAP protocols over time.

```
SELECT ?category (COUNT(?api) as ?count)
WHERE {
  ?api rdf:type lso:WebAPI .
  ?api prov:generatedAtTime ?date .
  ?api lso:assignedCategory ?category .
  FILTER (?date > "2012-01-01"^^xsd:dateTime
    && ?date < "2013-01-01"^^xsd:dateTime)
} ORDER BY DESC(?count)
LIMIT 5
```

Listing 5: The most popular API categories in 2013.

A more in-depth analysis using the Linked Web APIs dataset has been conducted in [8]. In particular, the dataset has been used as a reference dataset for link discovery in RDF graphs.

7.2. Survey on the Usefulness and Potential of the Dataset

In order to evaluate the potential and the usefulness of the dataset we have executed a survey. The survey targeted people which consume, develop and/or provide Web APIs. In the survey participated 29 people and all of the participants stated that they have searched or used an API, while 19 stated that they also provide an API. The results from the survey show that most of the developers find difficulties while searching an API – 3.4% find it very hard, 41.4% hard, and 27.6% somewhat hard. Also, majority of the participants welcome central API repository – 34.5% find it very helpful, 37.9% helpful, 20.7% somewhat helpful, and 6.9% little helpful. In the survey, we have asked the participants to indicate the usefulness of the Linked Web APIs dataset from perspective of a Web API consumer and provider. The results (cf. Figure 4) show that both, the consumers and the providers find the dataset useful. The results also show that dataset appears to be more useful for API consumers than for providers. According to the survey, the participants have shown interest in the dataset and stated that they will consider the dataset in the near feature.

In order to evaluate new potential third-party uses of the dataset, we have also asked the participants if they

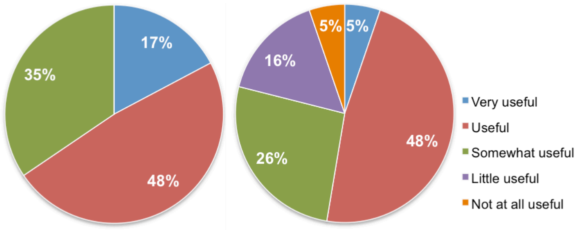

Fig. 4. Usefulness of the dataset as seen by consumers (left) and providers (right).

will consider the dataset in near feature (cf. Figure 5). As shown in Figure 5, consumers have shown more interest in use of the dataset than the providers.

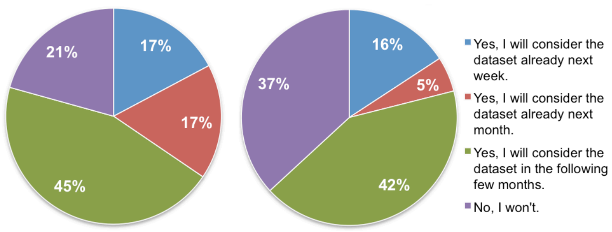

Fig. 5. Will consumers (left) and providers (rigth) consider the dataset in near feature.

Finally, in the survey we have evaluated list of possible use cases of the dataset. The results are as follows:

- 86% – Find and select relevant APIs.
- 86% – Increase the visibility of the APIs.
- 62% – Evaluate the recent trends in the API ecosystem.
- 59% – Compare APIs to others.
- 52% – Automated composition of Web APIs.
- 38% – Track the popularity of the Web APIs.

It can be observed that our goals for the dataset are well aligned with the possible use cases, as seen by the Web API consumers and providers. Complete results from the survey are available online[18].

In overall, the results from the survey, confirms the usefulness and the potential of the Linked Web APIs dataset.

8. Discussion and Future Work

8.1. Relation to Existing Ontologies

There are several proposals on machine readable descriptions for Web Services. hRESTS [7], SADI [10], WSMO-lite [9], Hydra[19] and the Minimal Service Model (MSM)[20] ontology, define models for Semantic Web Service descriptions. The Linked Web APIs ontology builds on top of the WSMO-lite, hRESTS and the MSM Semantic Web Service models and in near feature we will also provide alignment for the SADI model. SADI provides mechanism for automated discovery, composition and orchestration of Web services. Since the Linked Web APIs dataset provides large amount of information about Web APIs, it can efficiently aid the process of discovery of relevant APIs for SADI composition workflows.

Moreover, there are also non-Semantic Web standards such as WADL[21] and WSDL[22], which define syntactic descriptions for Web services. These syntactic descriptions are of high importance for the process of execution of Web services, individually or combined in service compositions. APIs.json[23] is another API description format which has recently gained attention by the API community. It is a JSON based format for public deployment of API descriptions and their further consumption by automated software agents. In our future work, we plan to add support for these API description formats.

In our future work, we also plan to integrate ontologies such as the SPARQL Service Description[24] ontology and the DataID[25] dataset description model [2] which will in turn allow description of SPARQL processing services and corresponding Linked Data datasets. Last but not least we want to evaluate possible alignments of the ontology with tagging vocabularies such as the MUTO[26] and SCOT[27] vocabularies.

8.2. Additional Data Sources

Currently, the Linked Web APIs dataset is populated with data from ProgrammableWeb.com. Nevertheless, our ultimate goal is to establish the Linked Web APIs as central Linked Data hub for Web API descriptions. To achieve this goal, we are currently working on enriching the dataset with API description from other data sources. The current ongoing effort is

[18] Results from the survey: `https://goo.gl/UeAbA7`

[19] `http://www.hydra-cg.com/spec/latest/core/`
[20] `http://iserve.kmi.open.ac.uk/ns/msm#`
[21] `https://www.w3.org/Submission/wadl/`
[22] `https://www.w3.org/TR/wsdl20/`
[23] `http://apisjson.org/index.html`
[24] `http://www.w3.org/TR/sparql11-service-description/`
[25] `http://wiki.dbpedia.org/projects/dbpedia-dataid-unit`
[26] `http://muto.socialtagging.org/core/v1.html`
[27] `http://rdfs.org/scot/spec/`

on integrating the API repository APIs.io[28] as part of the Linked Web APIs dataset. The repository provides over 1,000 API descriptions in the APIs.json[29] format. The APIs.json descriptions are being deployed in a decentralized manner, at the same domain from which the APIs are available. By integrating the APIs.io repository as part of the Linked Web APIs dataset, developers could publish and maintain their API descriptions, while at the same time, making theirs descriptions available as Linked Data. In our future work, we will also consider integrating API marketplaces such as the *mashape* marketplace[30].

We also plan to enrich the dataset with user profiles from traditional social networks. We want to interlink the tags and categories information with relevant datasets from the LOD cloud such as the Wikidata[31], Wiktionary[32] and Dbnary[33]. Last but not least we want to explore other applications using the dataset and assess its potential.

9. Conclusion

The growing number of available Web APIs requires new mechanisms to support the process of sharing, discovery, integration and re-use of Web APIs at large scale. In this paper, we have presented the Linked Web APIs dataset, the first Linked Data dataset providing Web APIs descriptions. The dataset supports i) *API consumers*-in the process of discovery, selection and use of Web APIs, ii) *API providers*-in increasing the visibility and tracking the popularity of their Web APIs, and iii) *API analysts*-in analyzing the API ecosystem. The dataset will also help to raise the awareness about the importance of providing semantic Web API descriptions and publishing them as Linked Data. The dataset has been validated in several recent works [4,5,8] in the context of personalized recommendations and link analysis. Also, on a set of usage scenarios we have shown the potential of the dataset.

Acknowledgement. We thank ProgrammableWeb.com for supporting this research.

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[32] https://www.wiktionary.org/
[33] http://kaiko.getalp.org/about-dbnary/

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