Enabling Citizen-empowered Apps over Linked Data

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Abstract. Smarter cities can be achieved by leveraging already available infrastructure such as Open Government Data and deployed sensor networks in cities, and, very importantly, citizens' participation through apps in their smartphones. This work contributes a platform, namely IES CITIES, with a two-fold aim: a) to facilitate the generation of citizen-centric apps that exploit urban data in different domains and b) to enable user supplied data to complement, enrich and enhance existing datasets about a city.

Keywords. Smart City, Linked Data, Apps, provenance, trust, JSON

1 Introduction

Smart cities aim to increase citizens' quality of life and improve the efficiency and quality of the services provided by governing entities and businesses. The IES Cities project is defined to promote user-centric mobile micro-services that exploit open data and generate user-supplied data. Its main contribution is to define an open Linked Data apps-enabling technological solution. Such platform will be deployed in different cities across Europe, allowing the citizens to produce and consume Internet-based services (apps) based on their own and external open data related to the cities.

Something especially remarkable about IES Cities is that users may help on improving, extending and enriching the open data in which micro-services, i.e. urban apps, are usually based. The main stakeholders of the resulting urban apps ecosystem by our envisaged smart city-enabling platform are mainly the citizens, but also the SMEs and public administration of different cities.

2 Related work

Users may enrich a given city's datasets by contributing with data through urban apps execution in their smartphones. However, the quality of such data may significantly vary from a given citizen to another. It is important to be able to assess and qualify the provided data, thus promoting valuable and trustable information and decrement-

ing and eventually discarding lower quality data. In order to address this, the W3C has created the PROV Data Model[1] for provenance interchange on the web.

Human Computation [1] enables to leverage human intelligence to carry out tasks that otherwise would be difficult to accomplish by a machine, e.g. identifying the names of people present in photographs [2] [3].

This work fosters the generation of provenance-based trusted Linked Data through citizen contribution, inspired by other works such as [4]. Users' data contributions are mediated by the IES CITIES-enabled mobile apps that leverage the back-end provenance support. Furthermore, this work proposes the use of JSON schema[2] and query languages[3] to facilitate urban apps development, since structured and non-structured data in the form of RDF, CSV or even HTML pages can be easily mapped into JSON.

3 A platform for urban and participatory linked data apps

The client/server architecture of the IES CITIES platform is shown in Fig. 1. The role of the *server* is to enable the retrieval and the storage of data provided by both users and public infrastructures. Independent developers create new services and register them; new datasets are also published and registered with the platform by public administrations. In order to track both the registered IES Cities services and users, the server manages their related information and current location and location scope, respectively. Thus, the server allows users to find and access services based on a degree of relevancy. The *client* app installed on the user's mobile device serves as the communication portal to browse and run services.

All information about services and users of the IES Cities platform is persisted in a PostgreSQL database and all the open datasets provided by city councils are registered and accessible through CKAN[4] for structured RDF datasets and TheDataTank[5] for semi-structured and unstructured data. The server accesses them whenever a dataset is requested by an IES CITIES app. A Virtuoso RDF store was also installed in order to handle linked datasets and user-provided RDF data managed by the platform.

Open data is fetched by defining a generic JSON-formatted query and sending it to the server's RESTful "`/data/`" interface, together with the requested dataset's name. This query consists of key/value pairs to specify required fields and optionally some parameters. The server side resolves the location of the requested dataset from the publication engines, after which it transforms the JSON query into the query language specific to the nature of the data's resolved endpoint. Currently, a query mapper has been implemented for both SPARQL, the query language for RDF, and SPECTQL, the query language used by TheDataTank[6].

1 http://www.w3.org/TR/2013/NOTE-prov-primer-20130430/
2 http://json-schema.org/latest/json-schema-core.html
3 http://www.jsoniq.org/
4 http://ckan.org
5 http://thedatatank.com
6 http://thedatatank.com/

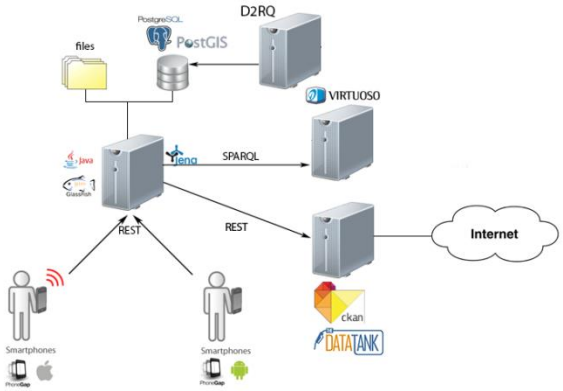

Fig. 1. Deployment of IES CITIES platform

The client application, the IES Cities Player, was developed using PhoneGap[7]. The GUI of the player was completely written in HTML5 and CSS3, using the JavaScript libraries jQuery and jQuery Mobile. Using AJAX, simple HTTP requests are sent to the RESTful "`/service/`" interface of the IES Cities server. This interface returns information in JSON format.

Fig. 2. 311 Bilbao IES CITIES service.

4 An IES CITIES-enabled app: 311 Bilbao

The 311 Bilbao (Fig. 2) is an IES CITIES-enabled app that uses Linked Open Data to get an overview of reports of faults in public infrastructure. It demonstrates how a developer can create a complex mobile app relying on semantic data, without tech-

[7] http://phonegap.com/

nical knowledge of the query language SPARQL. A query using JSON sent to the IES Cities platform's RESTful "`/data/`" interface is only needed.

During initialization, the service queries for reported faults, and displays the result on a map (Fig. 2a). Using the filter functionality on the second tab (Fig. 2b), a user can choose to see reports of only a certain type. By clicking on the marker of a particular report, the ID and the underlying nature of the reported fault is displayed. When the user decides to inspect the report an information page (Fig. 2c) is shown. On this page, users can read the full description of the report and watch an app snapshot. Notably, here, they are also able to vote the credibility of the report up or down, clue which is used to register and recalculate in the server the credibility score of such report. Finally, they can create their own reports (Fig. 2d).

5 Conclusion

The IES CITIES platform can be used to facilitate the use of open data from heterogeneous formats; all of it through a simple JSON query language. Moreover, citizens' involvement in the management of a city can be increased by allowing them to actively participate in the creation and validation of new data. The IES Cities platform helps councils to easily publish their open data in different non-proprietary formats, while making them accessible as common machine-readable formats through uniform REST interfaces, easily consumable by developers.

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