The alpha Urban LarKC a Semantic Urban Computing application

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ABSTRACT

This paper describes the alpha Urban LarKC, one of the first Urban Computing applications built with Semantic Web technologies. It is based on the LarKC platform and makes use of the publicly available data sources on the Web which refer to interesting information about a urban environment (the city of Milano in Italy).

Keywords

Urban Computing, SPARQL, Geo-data, Events, Linked Data

1. INTRODUCTION

Urban Computing is a branch of Pervasive Computing that investigates urban settings and everyday lifestyles. Clearly, cities are less controllable environments where it is hard to freely put sensors and apply traditional Pervasive Computing techniques. Nonetheless, the information to develop pervasive applications for urban environments is often already available: maps, points of interest, user locations, traffic, pollution, events are just a few examples of the digitalized information which we can access on the Web.

We believe that Urban Computing can largely benefit from the techniques developed by the Semantic Web community because a central problem of Urban Computing is information integration for which Semantic Web technologies already proved to be a valid solution. In order to experimentally verify the applicability of such techniques to Urban Computing, we are running a use case of the European research project Large Knowledge Collider (LarKC, for short, pronounced "lark") [3] dedicated to Urban Computing. LarKC aims at removing the scalability barriers of currently existing reasoning systems for the Semantic Web and implementing a platform for massive distributed incomplete reasoning. The LarKC platform is both a SPARQL endpoint exposed to client applications and a pluggable Semantic Web framework that allows developers to compose pipelines made up of plug-ins.

In this paper we present the first outcome of our research in this area. Section 2 illustrates the scenario, Section 3 explains what we concretely did and Section 4 gives relevant pointers and draws some conclusions.

2. TOWARDS A SEMANTIC URBAN COMPUTING ENVIRONMENT

This paper consists in the high-level report on the activities towards the so-called "alpha Urban LarKC", i.e. the implementation of an application that makes use of the LarKC platform and of some plug-ins to concretize some Urban Computing scenario. In this way, we not only took an important step towards the actual realization of a fully-fledged Urban Computing application, but, playing the role of "early adopters" of the technologies developed within LarKC, we also had the chance to face with all the problems of an initial experimentation with the platform and, as a consequence, to provide early feedback, lessons learned and new requirements to the platform and plug-in developers.

Due to the immaturity of the platform, the scenario we are currently able to demonstrate can seem to be quite limited; nonetheless, it is the first step towards the realization of a Urban Computing application that leverages all the possibilities provided by the Semantic Web and also paves the way to the use of more sophisticated reasoning techniques in this field.

A sample scenario for a Urban Computing application is the following. A user is in a (potentially unknown) city and would like to organize a day/night by visiting some places, meeting his friends, attending a music concert, etc. Therefore, he would like to plan his movement to his destinations, by possibly using a combination of transportation means (e.g. car, parking, subway, pedestrian). If the user does not know in advance the destination of his route, he could express some requests or ambitions and the destination is selected on the basis of those preferences. For example, the user says that he would like to go and visit some interesting monuments or venues of the city, or that he would like to attend some music concert or cultural event that night, or that he would like to meet some of his friends that happen to be in the same city. Therefore, his destinations can be

known places or some dynamically-chosen locations, like a monument – selected between the relevant ones of a city, which are the closest to the user's current position –, an event – among those published on the Web and taking place at a specific date-time – or a friend – whose position can change over time.

In order to fulfill the user request, numerous distributed and heterogeneous data sources should be accessed and several different parameters should be taken into account to calculate the "most desirable" path[1] for the user. The impact of the dynamic destination selection on the application business logic is that, first of all, a query should be routed to an appropriate data source (an archive of points of interests, a source of events schedules, a localization systems for a social network) and should select some possible destinations; then, for each destination, a suitable strategy to find the most desirable path should be adopted.

A thorough analysis of the requirements and the challenges for Semantic Web technologies in the Urban Computing field is presented in [2].

3. REALIZING THE ALPHA URBAN LARKC

The high-level representation of what happens in the alpha Urban LarKC application is graphically represented in Figure 1. It consists of a client application that invokes the LarKC platform to address the scenario described above, with reference to the city of Milano in Italy.

Figure 1: The alpha Urban LarKC application.

As depicted in the upper right corner of Figure 1, we configured the LarKC platform with three possible pipelines, as explained hereafter; as a gateway to them, a common plugin (called "Decider") analyzes the incoming query and forwards the request to the suitable pipeline for execution. The three pipelines are aimed to:

- Select the relevant *monuments* in Milano which can represent interesting destination for the final user. This pipeline executes a SPARQL query which looks for `dbpedia:Visitor_attractions_in_Milan`; in order to do this, Sindice[2] is queried to get the references to the correct DBpedia[3] sources, which are then scanned to find some details about those monuments, including their geo-position.
- Select the public *events* which happens in the current day in Milano. This pipelines executes a SPARQL query which looks for `rdfcal:Vevents`, their details and their locations; in order to do this, the popular Eventful[4] website is invoked through its REST APIs and its XML results are then translated into the proper RDF formal by following the GRDDL [1] approach.
- Calculate the most desirable *path* to one of the destinations selected by the other pipelines (a monument or an event). This pipeline executes a SPARQL query which looks for a path between a given point (the current position of the user) and a specified location (the selected destination); in order to do this, an operational research processor was used to calculate the path and was "wrapped" in a LarKC plugin to be executed in the pipeline; this proves the ability of LarKC to easily and seamlessly integrate in its framework results coming from communities different from the Semantic Web one.

[1]The most desirable path depends on the user request; it can be the quickest run by car, the shortest distance on foot, the less polluted path by bicycle, etc.
[2]Sindice `http://sindice.com/`.

4. CONCLUSIONS

The client application giving access to the LarKC pipelines described above is publicly available at `http://seip.cefriel.it/alpha-Urban-LarKC/` and an explanatory screencast is available at `http://seip.cefriel.it/alpha-Urban-LarKC/alpha-Urban-LarKC-demo.htm`. Our plan is to continuously add more feature and data sources to the current implementation, taking advantage of the future improvements and development within the LarKC project.

5. ACKNOWLEDGMENTS

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6. REFERENCES

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[3]DBpedia `http://dbpedia.org/`.
[4]Eventful `http://eventful.com/`