Towards Open-world Urban Sensing Applications

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1 Introduction

All urban sensing applications today take a closed-world approach, where specific data sources are applied for a specific purpose. They are designed with specific input/output interfaces and build their own dedicated server, each one with its own data format. Even though this approach is appropriate for applications that operate in a more closed, tightly controlled environments, it does not help common end-users to be able to access and use the vast amount of publicly available sensor data.

This raises the demand for a sensor data-sharing infrastructure, where people and their cellphone devices provide their collected data streams in accessible ways to third parties interested in integrating and remixing the data for a specific purpose. We suggest therefore, that instead of searching for the next killer applications the focus should be on the data itself, and a bottom-up approach should be taken on what to do with it. That means giving the right and necessary tools to the users, so that they can define their own proliferating sensing applications in a controlled way and potentially establish new use cases.

Our vision of participatory urban sensing is therefore an infrastructure that creates an open environment and allows end-users to easily access, extract and use appropriate information from multiple sensor sources over the Internet. In order to move toward the realization of this goal, we must address two technical challenges: First create a publicly accessible open distributed computing infrastructure, where heterogeneous sensor resources and complex end-user applications can be deployed, and automatically discovered and accessed.

Secondly, reduce the technical skill and time required to extract appropriate information from sensor data, which act as a barrier to a potentially large end-user community that could benefit from this data. Users do not want to deal with the complexity and scale of sensor data, but would prefer a view of the data that only exposes information, which can aid them in their application.

2 Mashing Up Urban Sensing with the Internet

The above challenges have been addressed at some extent by wireless sensor networks community. While earlier data collection effort was undertaken by individual organizations for a particular purpose, recently the interest has been concentrated on integrating sensor networks to the Internet, giving birth the to

notion of the Sensor Web. The problem with these approaches however is that they are rooted in the world of building tightly coupled distributed systems [1]. Hence these technologies involve relatively strong overhead on developing skills and supporting infrastructure and demand major investment of time. They cannot support service composition on the fly by simple users, but rather require experienced developers and a long lifecycle from design to deployment.

To achieve our objectives we need loosely coupled systems and a low barrier-to-entry for interacting with resources, such that users with low programming skills can easily accomplish new applications as they wish. Therefore we need to use new service composition technologies that significantly reduce overhead for users and allow on-the-fly customization and deployment. The programming model of Web 2.0 and its corresponding tools fit well with these requirements, and especially the concept of mashup. Mashups provide a way to generate entirely new applications by recombining existing resources (or applications) under a new context. This new emerging concept has attracted lately great interest and gained a big role in the Web ecosystem, mainly because it is proven to allow much faster, simpler and user-centric approach for service composition.

In particular, we advocate the development of future urban sensing projects using microformats with REST architectures to allow campaign applications to automatically harvest of changes, when a user uploads new data. REST (Representational State Transfer) is a type of Web Services based on architectural model to distribute hypermedia systems. It implements web services implementation uses XML and HTTP standards for data interchange and depends on microformats for service related information management. RSS and Atom are the most representative microformats.

Even though these standards were originally developed to provide an automated way to check for updates published on a web site, they are very flexible and extensible and allow their use in a variety of content beyond web sites and they have become prevalent as a way to publish and share information. In particular the Atom content model could be used to provide the applications with subscription links to the observation data. Besides, the support of Atom for extensions gives us the flexibility to add the GeoRSS format, in order to represent spatial information associated with sensor data, so we consider it the most appropriate for this paradigm.

3 Conclusions

In this paper we have argued that people's participation will be encouraged by infrastructures that take care of data accessibility and offer management capabilities to the users in order to build their own campaigns and control the flow of the data.

References

1. Wilde, E.: Putting things to REST. Technical Report Paper 2007-015, UC Berkeley School of Information (2007)