IASON - A Semantic Mobile Environment*

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Abstract

Intelligent filtering of information through personalization and location-awareness is an important problem in the mobile information society. Most current approaches to solve this problem in a mobile context consist in setting up a proxy to existing solutions on the semantic web which is accessed with standard mobile web clients.

We introduce the concept of a *Semantic Mobile Environment* and present its implementation. In such an environment, distributed service nodes provide semantcally annotated information to nearby mobile users. Personalization is realized by performing matchmaking between the description logics formalization of both the annotation and the user profile. An outstanding feature is that all reasoning is performed on the mobile device, so the approach is completely independent from any web services.

1 Introduction

A central idea of mobile semantic web services is to provide mobile users on the go with relevant location-aware and personalized information. The most straightforward way to achieve this is to use existing web services and simply provide a mobile interface to access them. Example systems provide templates to enter your location and interests, which are then used to retrieve relevant information. More sophisticated systems manage databases of user profiles and locations to provide more accurate information. All these systems, however sophisticated they may be, share a common weakness: they rely entirely on a connection to web services. Unfortunately the web was initially not designed towards a mobile use, so mobile semantic web systems tend to be unnecessarily complicated and hard to maintain.

In the following, we will present an alternative for providing personalized location-aware information to mobile users, namely the concept of a *Semantic Mobile Environment* (SME). We outline how we implemented such a SME and discuss to some extent its advantages.

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2 A Semantic Mobile Environment

The concept of a *Semantic Mobile Environment* (SME) is best explained by using an analogy. The vision of the semantic web, as described in [Berners-Lee *et al.*, 2001], was dominated by the idea of semantic web agents. It was to create an environment where *software agents roaming from page to page can readily carry out sophisticated tasks for users.*

In a SME, the mobile users are tha agents. Web pages are replaced by service nodes providing semantically annotated information to nearby mobile users. Example service nodes are small computers broadcasting semantic messages using bluetooth wireless connections, or simply RFID chips or 2D barcodes storing semantic messages. Even the user's mobile device may become a service node for social network services. Figure 1 shows a setup of a SME.

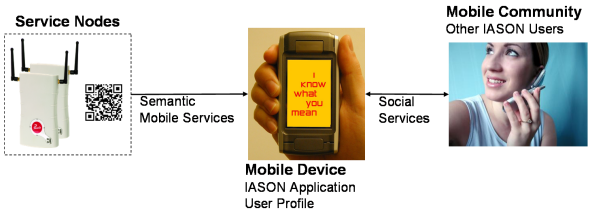

Figure 1: IASON Semantic Mobile Environment

A central idea of semantic mobile environments is that the mobile devices should no longer act as dumb terminal to complicated web services, but should rather play an active part in the personalization process. That's why the management of the user profile and the information filtering is performed entirely on the mobile device.

2.1 The IASON SME

The IASON system is an implementation of a semantic mobile environment. Figure 2 shows how the weight of the system has shifted towards the mobile application in contrast to common mobile semantic web systems. The IASON service nodes are small programmable access points with a bluetooth interface. All they have to do is fetch a set of semantically annotated messages from a connected database or a local file,

detect nearby mobile devices running the IASON mobile application, and send them the messages.

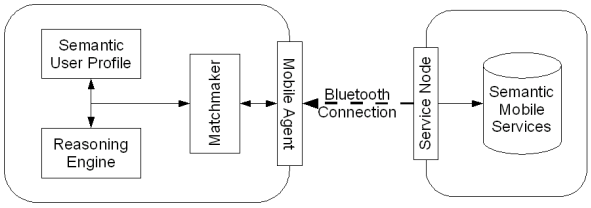

Figure 2: IASON Semantic Mobile Environment

Location-awareness is thus achieved by simply offering information where it is needed. There is no need to map any GPS coordinates to real locations or to triangulate cellular or WLAN signals, since the knowledge that a user is within a ten meter range of a service node is precise enough for our ends.

Semantic personalization of incoming messages is by far less trivial than our approach to localization. The whole personalization process of rating incoming messages in function of their matching the semantic user profile is performed on the mobile device. Three components on the mobile device are responsible for this, namely the semantic user profile, a mobile automated deduction system, Pocket KRHyper [Sinner and Kleemann, 2005], and a matchmaking component using the two other components. Both the message annotation and the profile description are formalized in description logics. The matchmaking algorithm is similar to the one described in [Li and Horrocks, 2003], but requires only two subsumption checks. It assigns one of three interest levels to each message, namely 'interesting', 'unsure', or 'not interesting'.

IASON is the first mobile system where the reasoning process is not taking place on a dedicated web server, but on the mobile device itself. There are more reasons to do this besides than showing that it is possible. First, it allows us to really stay independent from internet connections. Mobile connections are not available everywhere, and at least very expensive when abroad. This might change in the future, but there are more compelling reasons to consider putting more intelligence on the mobile devices.

In mobile semantic web systems, all user profiles are usually managed in a central database in the system. The big drawback is that the mobile user has to create a user profile at every service he wants to use. Profiles cannot be interoperable, since no service provider may (rightly so!) disclose user data to other service providers for privacy reasons. In the SME approach, the user profile is stored on the device, so it can be used for all semantic services, given the ontologies describing the profile and services are compatible.

Furthermore, collecting user data always raises privacy issues. If many user profiles are stored on a single server, the concerned users can never be sure that their intimate data are safe. The user profile database has to be encrypted and secured from theft. This is all but trivial. In our approach, no profile data ever leaves the mobile device. All necessary computation with the user data is performed on the device. Your personal data might of course still be stolen from your mobile device, but in this case it is only the data of one person instead of a few hundred. Also is the control over your data in your own hand, which is much more reassuring for the mobile user.

3 Conclusions

We have introduced the concept of a semantic mobile environment and presented an implementation of the concept. In such an environment, mobile users receive location-aware and personalized information about their environment. The concept can be applied to a wide variety of use cases, including public transport schedules, tourist guidance, gastronomy, recommendations in a wide variety of shops, cinemas and more.

The strength of the concept lies in its simplicity. Service nodes can be installed anywhere and need not necessarily be connected to the internet. Location-awareness is achieved by providing semantic messages where they are relevant. The annotation of these messages is matched against the user profile on the mobile device to sort out unwanted messages. The annotation and user profile are formalized using description logics picking up the ideas of the semantic web.

Both the management of the user profile and the decision support using the Pocket KRHyper reasoner are handled on the mobile device, which has not been done in other systems so far. This implies that no personal information ever has to leave the mobile device, which ensures the privacy of the user.

The fact that our semantic mobile environment is independent from any mobile semantic web services does not imply that their existence is to be questioned. Mobile semantic web services are still useful for actively 'pulling' desired information, while service nodes 'push' their messages on nearby mobile devices. It is rather imaginable that a message received in the semantic mobile environment triggers the user to connect to a mobile semantic web service to get more information about the subject.

References

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4 Software Demo

A simple installation of a semantic mobile environment consisting of two service nodes can be presented at the conference. Each service node as seen in Fig. 4 will provide a different set of semantic messages. Two mobile phones with different user profiles will show how different interests and disinterests will result in different recommendations from the service nodes.

Figure 3: IASON Service Node

Currently, the mobile application implemented in J2ME runs only on selected mobile phones supporting at least MIDP 2.0, CLDC 1.0 and JSR82. For the conference, it will be available for download, so everyone willing to try it out can do so.

Figure 3 shows a 'screenshot' of the mobile application after it has received some semantic messages. The different smileys indicate different interest levels for the messages.

Figure 4: IASON Mobile Client