Hiding the Complexity of LBS

Matthias Böhmer
Münster Univ. of Applied Sciences
Stegerwaldstr. 39
48565 Steinfurt, Germany
matthias.boehmer@fh-muenster.de

Gernot Bauer
Münster Univ. of Applied Sciences
Stegerwaldstr. 39
48565 Steinfurt, Germany
gernot.bauer@fh-muenster.de

Wolfgang Wicht
Münster Univ. of Applied Sciences
Corrensstrasse 25
48149 Münster, Germany
wolfgang.wicht@fh-muenster.de

ABSTRACT

While the demand for Location-based Services (LBS) is strongly increasing, technical laymen are not yet able to build and provide location-aware applications. This paper presents a radical simplification of the lifecycle of LBSs. An authoring toolkit enables non-technicians to easily develop context-aware mobile applications. In addition, an adaptive user interface makes the consumption of LBSs easier. The platform we present, in covering the whole LBS supply chain, is hiding the complexity of providing and consuming LBSs from the end-users.

Categories and Subject Descriptors

H.3.4 [**Systems and Software**]: Current awareness systems, User profiles and alert services; H.5.2 [**User Interfaces**]: User-centered design

Keywords

location-based services, end-user development, context-aware utilization, widgets

1. MOTIVATION

Mobile computing has become an omnipresent issue in modern information technology. The processing power of handheld devices is still steadily increasing and mobile connectivity is becoming faster, cheaper and more reliable. In addition, the penetration with embedded sensing capabilities is rising, especially for geographic positioning (GPS). Thus, on a technological level, the envisioned future of ubiquitous computing somehow has already taken place [1]. But on the application level, although the demand for LBSs increases, the role of provisioning ubiquitous applications is still reserved to professionals and the research community, due to the need of expert knowledge and proprietary development work. Furthermore, contrary to the evolution of the Web 2.0, where web-based services are very easy to handle, there is a lack of simplicity in the usage of current LBSs [2].

LocWeb 2009, April 4, 2009 Boston, MA, USA

Our motivation is to make the development lifecycle of LBSs much more feasible for authors as well as for consumers of LBSs. We propose a radical simplification of the provision and utilization of LBSs which unfolds a rich user experience. Instead of merely consuming ready-made applications, non-technicians should also be able to release custom location-based applications, according to their own individual requirements or to the requirements of other potential consumers. If such a widespread authorship leads to a blooming field of LBSs, filtering mechanisms have to be established. The subset of relevant applications, and only that subset, should be pushed to the consumers' devices automatically, taking into account the specific contexts and interests of the consumers.

Since the platform we describe here covers the whole LBS-lifecycle, we have two different kinds of end-users. First, there are the authors of LBSs. Their aim is to provide a certain LBS. In order to do so, they use an authoring toolkit. As providers of LBSs on the one hand and end-users of the proposed authoring toolkit on the other hand they have a twofold role. The meaning of end-user here relates to the field of end-user development. Second, there are the consumers of LBSs. In this case, while applying LBSs for their own needs and purposes, the notion of end-user as user of a service is obvious.

The notion of LBSs in this paper is used in the sense that the consumption of a LBS is relevant at a certain specific location and only at that location. This can, but must not mean, that the service makes use of the user's static or dynamic location.

The remainder of this paper describes our approach towards a radical simplification of developing and using LBSs. A prototype illustrates the end-user driven composition of custom location-aware mobile applications. The boundless opportunities for end-users are demonstrated by different use cases.

2. WIDGETS AS GOODS OF THE LBS SUPPLY CHAIN

For simplifying the development lifecycle of LBSs we introduce mobile location-based widgets as small and lightweight context-aware applications. The concept of widgets is well known from the web and already appears on mobile phones on some platforms, e.g. Widsets [4]. In general, widgets are frontends to services. In our case however, widgets in addition are supposed to have a contextual and semantic binding. While context mostly (but not exclusively) means

Figure 1: Web-based toolkit for development of widgets.

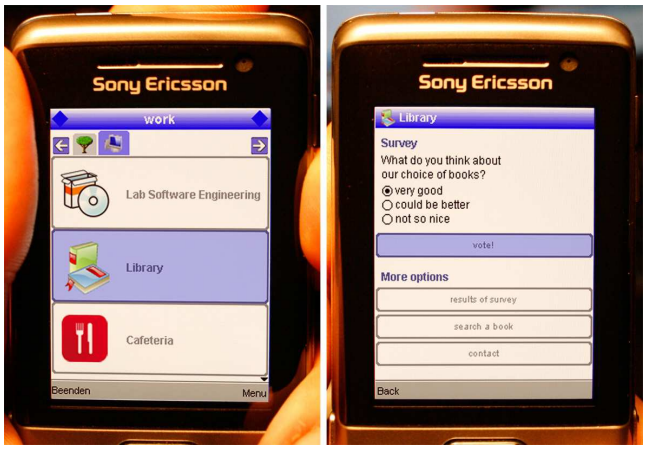

Figure 2: Widgets are pushed into the adaptive main menu (left). They serve as small clients for LBSs (right).

location, the most convenient way for users to give a semantic annotation is tagging [3].

According to our objectives, we want end-users to play a role at both ends of the supply chain: development and consumption. In this paper, end-users are common users without any specialized skills in programming or computer science in general. Everyone, who today already is able to run his own blog on the internet, should also be able to easily create a new LBS and use services of other people on his mobile device. Therefore we propose the following two processes of a user-driven provision and a context-aware utilization.

3. USER-DRIVEN PROVISION

For the provision of a new service, the end-user steps into the role of an author. For the foolproof authoring of new widgets we provide an easy and intuitive useable toolkit. It is web-based and allows authors to create a new LBS without the need of specialized skills in computer science. Figure 1 illustrates, that a widget can be composed by simply dragging and dropping items to the widget.

A widget mainly encapsulates the user interface of a LBS. It consists of one or more pages serving as screen masks. On these pages, the creator of a widget can arrange items like texts, input fields, images, radio buttons or buttons with certain actions, e.g. jumping to another page or sending the data of some input fields to a given email address. New Widgets can be designed from scratch or pulled together from existing resources, e.g. predefined templates for contact pages or surveys. Such building blocks are canned for the user interface and for functional logic. On a top level, widgets can also be generated for existing web services, e.g. news feeds.

Based on the concept of widgets, authors can not only contribute geo referenced information like texts or images for points of interest to the platform. Furthermore, they can build LBSs with possibilities for interaction and communication.

After the author has composed his new widget, he tags it and binds it to a location by simply dropping a pin to a map. From this moment, the widget is available as new LBS. It is being deployed on a platform and immediately available for usage by other end-users. The complexity of developing the user interface and the functional logic for a new LBS is hidden behind our toolkit.

4. CONTEXT-AWARE UTILIZATION

For the utilization of available LBSs, from the perspective of the platform the end-user steps into the role of a client. Currently the use of LBSs lacks due to the effort for installing and configuring applications. Our platform simplifies the usage by pushing widgets instantly to the client's device. The main menu shown in figure 2 adapts to the users context, it shows only widgets which are relevant to the user in his current situation. Icons of relevant widgets suddenly appear, when the corresponding LBS fits to the context of the user. Such services are instantly available for using them. After the client has chosen an entry from the menu, the widget is executed.

When everybody is able to build new LBSs, there will be a lot of services available in space. Due to limited screen size of mobile devices, the arising problem of choice overload has to be solved. Making too many services available on a mobile phone would confuse the end-user and make the utilization of LBSs inefficient. For prohibiting that the clients of the platform need to scroll through a long list of available services, we propose a recommender system. The current location is used to filter out LBSs too far away and therefore not interesting for the user. Assuming that the nearest service is most interesting, the spatial distance gives a ranking for listing the widgets in the menu. We also take into account the semantic annotation of a LBS. Users are able to personalize their interfaces by affecting the filtering with tags, which can be bundled to profiles, e.g. "work" or "leisure". Based on a user-profile and the semantic annotation of a widget, we can calculate a distance between them. By concatenating spatial and semantic distance, the location of a widget gets mapped from geo space into a relevance space. Here, interesting LBSs come closer, and LBSs which are less interesting drift away from the user. Figure 2 shows a list of widgets in a certain profile, which are rep-

resented as tabs. The push approach and the recommender system of the platform free the clients from the complexity of technical issues and the cognitive process of choosing appropriate services.

By simply tracking where, how often and how long widgets are used, we can also estimate an absolute relevance factor on the mass of widgets. We assume that most relevant widgets are used more often and longer.

5. PROTOTYPE AND DEMO SCENARIOS

Figure 1 and 2 show a current prototype implementation. We are running Java on the server and the mobile client and both communicate via HTTP requests. The whole scope from provision to utilization is realized and users already get the experience of how easy it can be to provide and use LBSs.

One interesting use case is about location-based surveys. Based on a template an author can provide a widget stating the question "How do you like it at CHI 2009?" and providing choices for answering. If this widget is tagged with "CHI", it will appear on the devices of users coming close to the conference building, if the widget is bound to this location and the users have similar tags in their profile. Users who have made their choice will see the result of the voting on the second page of the widget.

Another scenario is a widget for social networking. Users can build some kind of mobile avatar, e.g. containing personal information, a user image and a contact form. It is possible to bind this widget to the users own dynamic location. The widget will appear on devices of nearby buddies when the user is on the move. Unlike other buddy finders, we do not only show the location of the buddies. Instead, users are able to integrate their own communication opportunities, for example couple their personal widgets to their private blogs.

The predeveloped templates of the widget toolkit only provide a frame for widgets. Users can modify them according their own needs and wishes, e.g. add some images or extra pages, rename buttons or add choices for voting. The opportunities are manifold and easy to use.

6. CONCLUSIONS AND FUTURE WORK

In this paper, we presented our view of location-based systems, claiming that they should be made feasible for end-users. We presented a concept for the design of such a system where widgets are used as lightweight and location-based applications. A prototype for proof of concept was described. It enables a strongly simplified development and consumption of LBSs for non-technicians.

We developed a mobile user interface which makes use of location information to retrieve relevant widgets for LBS-usage. In addition to location-awareness users can personalize the filtering by defining tag-based profiles. So the plattform is able to prevent the problem of choice overload.

For future work, the functional features of the widgets will be extended and new building blocks will be offered. We also want to delve deeper into context-aware filtering and take into account other sensing capabilities of today's mobile devices, e.g. 3D accelerometer for inferring user behavior. Moreover we expect interesting results from correlating semantics and locations. Data can be derived from profiles of moving users and widget tags bound to certain locations. Furthermore we want to improve the UI of the web-based toolkit and the mobile client for better user guidance.

7. ACKNOWLEDGEMENTS

This work was funded by the German Federal Ministry of Education and Research under grant 1748X08.

8. REFERENCES

[1] G. Bell and P. Dourish. Yesterday's tomorrows: notes on ubiquitous computing's dominant vision. *Personal and Ubiquitous Comp. (2007) 11, 133–143.*

[2] M. Böhmer, G. Bauer, and W. Wicht. LBS 2.0 - Enabling User-Driven Provision and Context-Aware Utilisation of Location-Based Services. *Proc. UBICOMM 2008, 374–375.*

[3] F. Carmagnola, F. Cena, O. Cortassa, C. Gena, and I. Torre. Towards a Tag-Based User Model: How Can User Model Benefit from Tags? *User Modeling (2007), 445–449.*

[4] WidSets. Mobilize your web. http://www.widsets.com/.