Demonstrating FLAVOUR: Friendly Location-aware conference Assistant with priVacy Observant architectURe

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Abstract. In this paper, we describe an implementation of FLAVOUR (Friendly Location-aware conference Assistant with priVacy Observant architectURe), in which people/infrastructure resources act as individual service providers offering their location as a service. By subscribing to this service, in the one hand, conference participants can be aware of each others whereabouts as well as being able to chat. On the other hand, conference organizers can notify interested attendants about special events such as cancellation of a track or change in the presentation rooms. The presented architecture uses existing WLAN infrastructure for cost efficiency, and uniquely incorporates the location information as a service into Jini service discovery platform. Location itself is determined with high accuracy by using a calibration free technique.

1 Motivation

We all have occasionally experienced being alone in a foreign territory. Naturally, it had come to our mind it would have been nice if we were accompanied by a trustworthy native person who knows a great deal about the area, places worth visiting, and how to find our way and our interest points, etc. As unrealistic as it may sound, that is exactly what this research aims at, i.e., building a mobile guide to (temporarily) be your best friend when you are attending a conference.

Equipped with 650 individual wireless network access points, with each point having a range of about 100 meters, in June 2003, University of Twente (UT) announced the launch of its wireless campus. In short, spread over 140-hectare campus, UT offers its staff, students, as well as its visitors, i.e., anyone with a desktop, laptop, handheld or wireless fidelity (Wi-Fi) devices to wirelessly access the university’s network and the internet from everywhere on the campus [5]. Availability of such an infrastructure and the fact that SVGOpen 2005 conference was scheduled to be held at UT, were two strong driving forces towards building a user-friendly conference assistant, in which location proves to be one of the key components.

There are numerous location-aware applications, being employed in various environments and used by diverse user groups, which are developed using WLAN infrastructure. There are several great challenges that these applications face. Four of them are as follows:

– Localization: Despite of offering many advantages such as providing economical solution, higher coverage, and scalability, Wi-Fi based localization techniques in general suffer from high calibration effort. The calibration needs enormous amount of manual labor and should be performed repeatedly. As a rule of thumb, there is a trade-off between the amount of effort put on reducing the calibration and the accuracy obtained. For instance, Ekahau positioning system [6] offers an accuracy of about 1 m, while it requires quite a lot of calibration effort. On the other hand Place lab [7] does not involve much calibration, and the reported accuracy ranges from 13 to 20 m.
– Heterogenity: End-users may utilize various personal devices on which different platforms run. Hence supporting interoperability between various devices and platforms is mandatory and by no means is an easy task.
– Privacy: It is very easy to create and implement big-brother scenarios that track users movements and allow to deduce patterns of behavior. Careful definition of privacy policies and a proper architecture design can reduce or even eliminate this risk.
– Infrastructure: Since applications are often built on top of already existing infrastructures, requirements of the applications may not always be met. In other words, to be (better) operational, applications may require add-on to the existing infrastructure.
To address the above challenges, we developed a research prototype called FLA VOUR (Friendly Location-aware conference Assistant with priVacy Observant architectURe).

2 Features of FLA VOUR

The important features of FLA VOUR are:

- **Offering location as a service:** In FLA VOUR each conference participant/infrastructure resource acts as an individual service provider. This means that, location of each individual is published as a service to which interested participants may subscribe.

- **Providing multiple services:** Both pull and push services are provided by FLA VOUR. Examples of the former include (i) finding fellow attendants, and (ii) locating and using resources available in the infrastructure such as printers, copiers, coffee machines etc. Being notified about important events by conference organizers (iii), and communication with other contacts, i.e., colleagues, friends etc.(iv) are examples of the latter.

- **Accuracy:** Compared to existing WLAN-based localization techniques, which rely on huge calibration phase, localization method used in FLA VOUR offers an accuracy of $6 \text{ m}$ in average with zero calibration effort.

- **Highly dynamic interface:** Since FLA VOUR utilizes Scalable Vector Graphics (SVG), panning, zooming and other functionalities at the user interface are performed very fast. Also due to having SVG viewer on the client side, rendering of the SVG map can be done quickly.

- **Privacy:** FLA VOUR does not have tracking functionality. Users can be aware of each others location only if they have proper privileges. FLA VOUR gives users the freedom to choose whom and for how long can access their location information.

- **Availability of services in off-line mode:** Due to the limitation in battery, user devices are not always on. An important feature of FLA VOUR is to be able to provide its services even if the user device is switched off. In this case people can be aware of the location that the off-line user was last seen and the user himself can receive off-line messages once he is online.

- **Platform support:** At the moment, FLA VOUR runs on both Windows and Linux platform.

3 Service-oriented Architecture

Figure 1 represents 3-tier FLA VOUR architecture, which consists of client side, surrogate host and server side. Both surrogate host and server side reside on Jini infrastructure. The following building blocks are the key components in the implementation of FLA VOUR:

- **Device Location Service (DLS):** It consists of spotting functionality, which scans for near-by access points whenever the client requests its location.

- **Device Agent Service (DAS):** The copy of DLS instantiated in the surrogate host together with the mapping service form the DAS. Mapping service itself is responsible for overlaying location coordinates on the footprint map.

- **Reggie:** It registers all the available services so that they can be used through Jini infrastructure.

- **User Device Manager Service (UDMS):** When the DAS needs to know the location of other buddies, a request is sent from the client to UDMS which is residing on the server side. To offer/take back its own location, DAS registers/de-registers its location information to/from this service.

- **Access Point Information Service (APIS):** It is a database providing the location of the access points in the area of interests.

- **Location Manager Service (LMS):** The estimation of the actual location is accomplished by LMS. Although LMS resides on the server side, it does not keep any record of the estimated location. In this way user privacy is maintained. Only in a special case, i.e., when the user is off-line, a record of the location where the user was last seen is kept.

- **Buddy List Service (BLS):** It contains the list of buddies subscribed to a location service provided by a particular user. In addition it is responsible for re-directing all the authorization requests as well as storing messages when the user is off-line.

- **User Announcement Service (UAS):** It is the Jini representation of a client in the surrogate host, which only exists when the device is on. UAS basically facilitates communication between BLS and the client.
4 Demonstration

Our demonstration consists of three major parts. First, we present locating individual conference participants as well as available resources in the infrastructure. Second, we show how individual users can be aware of each others location. Last, we illustrate the massaging capability of the system both from the organizers point of view and participants. Various snapshots of FLAVOUR can be seen in Figure 2.

5 Conclusion

In this paper, we presented FLAVOUR, a privacy-sensitive, location-aware service architecture for conference environment. FLAVOUR uniquely incorporates location information into the Jini service discovery platform to provide conference participants with service sharing based on their location. It also facilitates the availability of location information even when the user is off-line. The location is determined with high accuracy by using a calibration-free localization technique. Another advantage of the presented architecture is cost-efficiency because it uses existing WLAN infrastructure.

On-going work includes enhancing the accuracy of localization technique. Not to end up with a big-brother scenario, we plan to incorporate more privacy policies in the future. Last but not the least, we also aim at extending FLAVOUR to encompass campus-wide services.

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Fig. 2. Snap shots of FLAVOUR prototype

References

2. http://www.w3.org/TR/SVG/intro.html
3. Kavitha Muthukrishnan, Nirvana Meratnia and Maria Lijding: FLAVOUR- Friendly Location- aware conference Aid with pri-
7. Anthony LaMarca and Yatin Chawathe and Sunny Consolvo and Jeffrey Hightower and Ian Smith and James Scott and Tim
Sohn and James Howard and Jeff Hughes and Fred Potter and Jason Tabert and Pauline Powledge and Gaetano Borriello and Bill
Schilit, Place Lab: Device Positioning Using Radio Beacons in the Wild, Proceedings of Pervasive’05, Munich, Germany.