PerAd-Service: A Middleware Service for Pervasive Advertisement in M-Business

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Abstract
In this paper, primarily, we delineate the numerous challenges that can arise in mobile-business (m-business) to provide the highest degree of proliferation of pervasive advertisement. Later, we demonstrate the feasibility of PerAd-Service, an integral part of MARKS (Middleware Adaptability for Knowledge Usability, Resource Discovery, and Self-healing) to address those challenges.

Introduction
The rapid expansion of ubiquitous/pervasive market (255 billion USD to 791 billion USD within next 5 years) [1] makes it obvious that pervasive advertisement is going to play a very important role in near future. It will provide even better advertisement platform than effective online advertising [2, 3]. Here, three types of people are closely related: users, advertisers, and ad-providers. The users are those targeted people to whom the advertisements (ads) should be reached. The advertisers want to exhibit the ads of their products to the users through the ad-providers. The ad-providers are responsible for making ads, keeping and displaying all the necessary ads, etc. By doing so, they expect money from the advertiser. To maximize the benefit of pervasive advertisement, it requires the solution of all the following challenges:

1.1 Challenges from the users’ view

*No payment for viewing the ad:* Users do not pay anything directly for viewing the online ad. However, they have to pay the Internet providers or cell-phone companies in regular basis for their services. How is it possible to make the pervasive ad absolutely free for the users?

*Privacy and Security:* The privacy and security of the users should not be breached. If needed, the information of their preferences should be stored in their own devices, not elsewhere. How can it be done?

*Ubiquitous access:* The ad should be accessible from anywhere at anytime according to the users’ will.

*Follow up the ad [2]:* How will the users respond regarding to an ad? How will the wireless connection be used for the communication?

*Ad viewing time:* When the users will view the ad? Just after choosing the ad? At free time? In that case, how should the references of the ad be stored? Who will store that?

1.2 Challenges from the advertisers’ view

*To reach the right people with right ad at right time in the best way [2]:* How is it possible to choose the right people for a specific ad or to choose the perfect ad for a specific person? Is it really possible to determine the right time for everyone? In most cases, the users get annoyed by the sudden ad in mobile devices [4]. Hence, serendipitous advertising [2], the advertising which seems not to be important for the users, but may make them interested about that, is not effective way to reach people. Which is the best way for this purpose?

1.3 Challenges from the ad-providers’ view

*Use of existing resources:* Is it possible to incorporate the ads in existing infrastructure to make the process of displaying ad cost-effective?

*Collection of ad revenue [2]:* How will the ad-providers collect the ad revenue from the advertisers?

2. PerAd-Service: Our Approach to Address the Challenges

We have developed the first prototype of MARKS [5] to use in mobile devices including Pocket PCs, Palm devices, etc. Currently, we are working on PerAd-Service of MARKS, which can be deployed to solve most of the challenges mentioned above. To maintain the security, we are building a trust model.

2.1 Proposed Architecture of PerAd-Service

Unlike [2], to make all the advertisements worthwhile, here we assume that the advertisements will be displayed only in mobile devices; not in other places like wall, walkway, etc. The ad-providers will store all the ads inside the ad-keeper, which might be any suitable existing device like a vending machine. PerAd-Service will serve the functionality of the middleware as well as the communication media for both the users’ devices (let, PerAd-Service_u) and ad-keepers (let, PerAd-Service_a). Each ad should have a unique ID (like C10109) consisting of the advertiser ID (here, C1) and the ad ID (here, 0109).
2.1 Solution of the Users’ Challenges

PerAd-Service will use the functionality of Knowledge Usability (KU) [6], a fundamental part of MARKS. KU acts as proxy of the users and keeps preferences provided by them during the installation of MARKS. Figure 1 shows the overall structure of MARKS along with PerAd-Service.

In pervasive ad, the users do not need to register, hence do not need to pay anyone. Due to having proper knowledge of the users’ preferences, the KU of PerAd-Service will communicate to the PerAd-Service of the user’s device itself.

The KU maintains the schedule and the to-do list of the user. After consulting the KU, the Per-ad-service determines the user’s best time to display the ad in the mobile device. The user can follow up the ad according to the information stored by PerAd-Service.

For instant follow up, PerAd-Service will communicate to the corresponding advertiser. Since security can be breached during communication, the Self-healing part of MARKS, is added in our design.

2.2 Solution of the Advertisers’ Challenges

As the user’s guide, the KU of the PerAd-Service assists the advertiser to choose the right people and the suitable ad. The advertiser does not need to think about the perfect time and the best way to display the ad since these two variables would be handled by PerAd-Service of the user’s device itself.

2.3 Solution of the Ad Provider’s Challenges

To collect the revenue (Rev), PerAd-Service will keep track of all the ads (let, N1, N2,.. Nr), whose ID are collected by the KU. So,

$$\text{Rev} = \sum_{i=1}^{r} N_i * W_i * R_i$$

Where N, W (Weighting factor), and R (Expense Rate of an ad) are prefixed by the ad-provider and the advertiser.

3. Prototype Implementation and Conclusions

We are at the edge of the first prototype of PerAd-service of MARKS. Figure 2 describes how the PerAd-service shows the user all the stored ads at appropriate time. Here, the user chooses “Basketball Ticket Sale” option to see its details.

In this paper, we have described how MARKS can be utilized in pervasive advertisement, a very potential area in pervasive computing. In near future, after completing the development of PerAd-Service, this will be evaluated in real world.

Reference