Collaborative Advertising over Internet with Agents

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Abstract
In this work we discuss an approach to advertising over Internet using software agents. The agents represent users of mobile devices and service/product providers. The user agents autonomously analyze advertisements by cooperation and negotiation with provider agents and notify the user when interesting offers are found. Notifications and offer descriptions are sent using email, SMS messages and WML-pages. Agents may form coalitions for collaborative work such as co-shopping and co-advertising. A prototype implementation of the discussed advertising service is done using the Agora environment for support of cooperative work in multi-agent systems. Basic features of the environment are briefly discussed.

1: Introduction

The number of mobile devices (such as cellular phones or PDAs) in use increases rapidly in the last few years. This provides a good opportunity for implementation of information and e-commerce services for users of these devices. In particular, development of the WAP technology [10] makes it possible to provide users of cellular phones with access to the Internet and, as a consequence, to use services which earlier were available only via PCs connected to the Internet. However, there are several problems which should be solved in order to support these services. Providing a good availability of e-commerce services (anytime and anywhere), mobile devices and mobile communications suffer from quite basic restrictions: low bandwidth, limited expressive capabilities and high connection cost. In order to relax these restrictions, precision of the information delivered to a mobile device should be very high: the information should be personalized and its amount should be as small as possible but sufficient enough to be useful to the user. We think that in order to fulfil the above-mentioned requirements most of the work for information analysis and processing should be done off-line and independently of the user’s requests. Taking this into account we think that software agents [2, 11] are very suitable for doing this work.

Our approach can be formulated as follows. We assume that users of the mobile devices can be represented by software agents in the Internet. The agents will keep user interests/profiles, preferences and other user-related information and search, analyze and filter information about available services according to the user preferences. After such analysis the agent may decide which information is valuable for the user, in which amount and at what time. Following this decision the agent will send only highly relevant information to the user of mobile device. The information can be sent with different levels of details using SMS messages, WML-pages or traditional email depending on its priority for the user. We also would like to underline that intelligence of the agent can vary for various applications, and it may include a wide spectrum of capabilities from a simple filtering to a pro-active reasoning, learning and taking into account user’s geographical location, time, date, seasons etc.

Doing next step in this approach we assume that service providers can also be presented by their software agents, and they may be involved into a dialog (negotiation or coordination) with user agents. This is important for achieving personalization of services. Supporting customers and/or service providers coalitions formation is another possible development of the approach. Such coalitions allow exchanging useful information and developing a common policy. Coalitions also provide opportunity for collaborative work of customers, providers or both. Some aspects of the above-mentioned agent-based approach to service provision were considered in [7]. In the present paper we discuss collaborative aspect of the approach and consider application of the approach to a problem of advertising.
over Internet using agents. A prototype of an advertising service is implemented using the Agora system – a multi-agent system for support of cooperative work which we developed earlier [5,6].

The rest of the paper is organized as follows. First we briefly describe some problems related to advertising over Internet and some possible ways of their solving. Then we present our solution to the problems. Next we discuss basic concepts of the implementation framework (including the Agora system). Then we consider some details of implementation of the prototype and, finally, we present conclusions.

2: Advertising over Internet

We are interested in developing models and tools for advertising services and products over Internet to the users of mobile (WAP-enabled) devices. To the best of our knowledge there is not much done in this particular area. However, there are many works which use web, email and Internet for advertising purpose [1,3,8] and some of these works might be adapted to mobile devices usage. In general, the main problems in advertising services and products are related to finding potential customers and making the customers aware about the provider’s offers. The following two approaches to solving these problems can be identified [4] as the most often applied: 1) The personal contact approach: advertising company looks for, identifies and contacts each potential customer individually; 2) The mass media approach: advertising company delivers advertisements and other information to all potential customers at the same time by broadcasting over mass media.

The personal contact approach allows advertiser to personalize the offer and sometimes to have better response from the customer, while it requires substantial amount of work to be done. This approach is also referred to as one-to-one marketing. An advantage of the mass media approach is that it allows the same advertisement to reach many people at the same time. However, there is no guarantee that the target group of potential customers (which the advertiser would like to involve into buying process) is reached by the mass media advertising. This approach is also referred to as one-to-many marketing.

Considering the Internet as a media for advertising we should mention e-mail and web-site based advertising. Email based advertising is a popular way to reach potential customers. However, getting a large number of unsolicited emails from unknown (and often untrustworthy) sources may annoy receivers of such emails. Quite often, most of such emails are not read at all, and they even may create a negative impression about the companies which use such method of advertising. The most popular method of web-site based advertising is usage of graphical banners (banner ads). Problems with web-site based advertising are related to creating awareness of the site to potential customers, attracting visitors of the site and measuring success of the advertising process. In other words the problems can be re-phrased as follows: where to allocate banner ads that it would be visible to the target group of customers, and how to motivate potential customers click on the banner.

WAP-based communication adds some special features to the advertising process. In spite of the fact that WAP allows adapting many web-based solutions, there exist conceptual differences in browsing the web by users of WAP-enabled devices compare to PC users as well as differences in a way of usage of mobile devices compare to usage of PC. The differences are related to restricted capabilities of WAP-enabled devices (small screen, high cost of connection, complicated input etc.) and specificity of behavior of users of mobile devices (very focused queries, availability of device/services anytime, Internet inexperience of most users etc.).

Basically we can summarize the above-mentioned problems with advertising as follows. Service providers (advertisers) are interested in a wide but focused advertising directed to some target groups or to individuals. The problem in this case is in discovering such target groups – users are not willing to disclose their private preferences to somebody they don’t completely trust. Users of mobile devices are interested in getting valuable information and offers from the service providers. However, they often don’t know which of the service providers are relevant to their interests and, again, they don’t want to disclose their private preferences to somebody. Another problem with users of mobile devices is that they are not willing to receive irrelevant information to a small screen of their device and scroll useless offers hoping to find something useful (this, actually, may lead to loss of interest to the advertising in general).

3: A proposed solution

Our approach is as follows. Each user of mobile phone/device can be represented by a software agent. The agent will exploit traditional software agent characteristics like autonomy, pro-activity, reactivity and ability to communicate [11]. The agents encapsulate user preferences, and they run in a protected environment (for example, this may be a user host). The user preferences may be expressed using a wide spectrum of capabilities
Advertisements can be put to an advertising desk and both users and providers should have access to the advertising desk via communication channels. Basic scenario in our case can be as follows. Service provider agents put their advertisements to an advertising desk. User agents can read advertisements from the desk, analyze them, filter (or do another processing of the offers with respect to presented user preferences/profiles) and select offers which are relevant to the user interests. The selected offers can be placed to the user’s WML-pages accessible from a mobile device. The agent may also reorganize the user’s WML decks in a way that more important offers are placed at the beginning of the offer list where they are easily (faster) accessible by the user. If an offer should be processed in real-time (for example, time of validity of the offer is restricted) then the agent can send the offer as a SMS message to the user’s phone (or use another push-technology [10]). The message will inform the user about the offer, and it may contain a reference to the WML-page where a more detailed description of the offer is available. If more information about the offer is required then the user agent can contact the provider agent and start a dialog with it. The dialog may include both inquiring details about the offer, negotiation about offer consuming and, may be, disclosing some user preferences to the provider agent in order to get more personalized service. In this case advertising desk can be organized as an advertising marketplace (see Figure 1) with full support for cooperative work such as negotiation, matchmaking etc.

Figure 1. Marketplace for advertising

Basic advantages of the proposed approach are as follows: 1) User may keep his preferences private and doesn’t need to disclose them to somebody (the result of analysis and a set of selected offers to be presented to the user will not be known to somebody except the user); 2) Advertiser doesn’t have to know addresses of members of a target group but rather put his offers to a place where interested parties can get access; 3) Agents working autonomously may process a huge number of offers off-line without bothering the user; 4) All processing can be done asynchronously, and this allows a good scalability of the advertising process; 5) An offer can be sent to a mobile device, and this provides an opportunity for real-time reaction to the proposed offer; 6) Agents may perform advance cooperative activity via marketplaces; 7) Agents may form coalitions for cooperative analysis/filtering the offers.

Main drawback with the proposed approach is related to necessity for the user agents and service agents to be aware about the relevant advertising desks/marketplaces. We think that such marketplaces can be supported by advertising agencies in the Internet, and the agencies should earn a reputation in order to increase their awareness. It is also possible that some of the public (non-commercial) but well-known marketplaces (for example, regional or government supported marketplaces) will play an important role in advertising process.

Having one advertising marketplace for all-possible services or products seems to be not very practical solution. We think that there can be different advertising marketplaces for different types of products and services (see Figure 2) and the advertising marketplaces may constitute a complex advertising network. In general, categorization of the advertising network can be done by products, by brands, by countries etc.

Figure 2. Structured advertising marketplace

The agents (both user and service agents) can be registered in several marketplaces, and they can migrate from one marketplace to another depending on results of their activity. Service agents may also adjust their offers depending on quality of feedback (for example, a number of requests from the users for additional information).

Usage of marketplaces in advertising can be considered as a many-to-many marketing.

4: Implementation

We use agents and marketplaces as basic elements of the advertising system architecture. In order to facilitate deployment of these basic elements we use Agora framework [6] for cooperative work support. Briefly speaking, Agora is a cooperative node in the Internet where agents can register their interests and get a support for matchmaking, negotiation, coordination and communication. Each cooperative node has a manager
agent, coordinator, negotiator and communicator. The manager performs registration, matchmaking and events handling. The coordinator and negotiator are agents which manage some coordination or negotiation protocol (for example, negotiator may be an auctioneer when an auction protocol is used). The communicator supports communication between agents and Agoras as well as between different Agoras. All components of the cooperative node can be overridden when needed (for example, different negotiation protocols may need different negotiator agents). The Agora system provides APIs for generation and customization of the cooperative nodes. Generation of agents in the Agora framework is also supported by APIs, and a default agent in the Agora system has goal analyzer, planner, knowledge base and communication modules. All agent components can be customized or overridden and their functionality can be different for different applications.

Taking the Agora concept and the Agora system as basic means for implementation we, first, identify participants of the advertising process. In our case they are users of mobile devices, service or product providers (advertisers) and advertising agency. Next we identify possible cooperative work to be done in the system. It includes coordination of activity of the advertising agency, negotiation between user agents and provider agents and coalitions formation and coordination. The participants and cooperative work can be mapped into agents and Agoras as it is shown on Figure 3.

**Figure 3. Agoras and agents for advertising**

In Figure 3, rectangles denote agents and diamonds denote Agoras (shadow Agoras mean that there can be more than one Agora of this type and dim rectangles denote Agora components – coordinator and negotiator). Advertisements are divided into different categories allowing to have grouping of interests when it is useful. The Advertising Agency Agora keeps track of registered Category Agoras, and it may recommend agents to register at one or another Category Agora. The categories are defined by the Advertisement Agency or by service providers. Each agent (user or provider) can choose categories which it is interested in and register at corresponding Agora(s). During registration provider agents present their offers to the Agora. User agents can also present their preferences to corresponding Agora (if this doesn’t violate their privacy). In this case Agora manager performs matchmaking offers and preferences. However, this is not possible if users do not disclose their preferences. When this is the case, user agents read the offers from the Agora but may perform their analysis in a private protected environment. Agents (both user and provider) can be registered at more than one Category Agora.

### 5: Running scenarios

We consider the following possible advertising scenarios for the above-described approach: 1) Last minute offers: rest tickets for sale a short time before the event. Notification via mobile device is very important in this case because of real-time decision making; 2) Promotion of goods: traditional advertisement of a product. Here mostly matching preferences and offers is important; 3) Co-Shopping: collecting requests for the same product from several customers and trying to get discount for a large volume. This mostly concerns formation of coalitions for buying; 4) Co-Advertising: this is related to cooperation between different providers (usually providers of different but complementary services) in order to propose a package of offers.

The first two scenarios are based on the solution presented in the previous Section.

The Co-Shopping scenario may require creation of special marketplaces implemented by Agoras. There are two possibilities in this case. First, after receiving some requests for a product, provider announces the product for co-shopping and creates a marketplace for it. Interested agents may register at this marketplace, and when a critical mass of requests for the product is reached the buying started. A negotiation can be performed between customers and providers about a value of critical mass and about a corresponding price. Agents and Agora implementing this case are presented on Figure 4.

**Figure 4. Co-Shopping: active provider**

Second possibility for co-shopping can be described as follows. Customer agents create a marketplace (without participation of a provider agent) where they present their interests in shopping. The marketplace
performs matchmaking and finds common shopping interests. After that customer agents with common interests create a new marketplace and announce it to provider agents. Provider agents interested in providing required products/services may register at this Agora and negotiate with customer agents about the volume and price. Agents and Agoras representing this situation are shown on Figure 5.

Figure 5. Co-Shopping: active customers

The Co-Advertising scenario assumes creation of advertising marketplaces where cooperating providers propose a set of complementary products or services. In this case the customer agent selects a set of services (or products) from the offers and then starts negotiation for possible discount for the whole selected package. Agents and Agoras for this case are presented on Figure 6 (we would like to notice that this case is symmetric to co-shopping with active provider on Figure 4).

Figure 6. Co-Advertising Agora

A prototype version of the advertising system [4] was developed for the Last minute offer and Promotion of goods scenarios while implementation of the Co-Shopping and Co-Advertising scenarios is under development now. The Agora system GUI is used for creation of agents and for monitoring the advertising process. Agent behavior and communication protocols are presented in an XML-based language as plan-files and action-files [6]. Communication between agents and users is done by email, SMS-messages sending or/and creation of WML-pages with offer descriptions.

6: Conclusions

We propose a usage of software agents for advertising over Internet. Basic advantages of this approach are related to supporting privacy of user preferences, off-line processing, pro-active filtering and analysis of offers as well as relaxing necessity for discovering target groups by advertisers. We also think that usage of marketplaces for advertising is a fruitful approach and it allows to have a better personalization of services via negotiation. At the same time ability to form coalitions provides a good opportunity for collaborative work between customers and/or service providers.

Usage of the Agora system for the implementation demonstrated practical convenience of the Agora-based approach as a conceptual support for cooperative work. We also would like to notice that usage of the WAP technology is not critical in our approach. Any other protocol allowing communication of mobile devices with Internet can be easily attached to the system.

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