Enabling Personalized And Context Sensitive Mobile Advertising While Guaranteeing Data Protection

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Abstract: *Advertising on mobile terminals is a consequential advancement of traditional methods of advertising. In this article we will discuss the special potentials and challenges of mobile advertising and introduce the MoMa-system as approach to enable personalized and context sensitive advertising while guaranteeing data protection, whereas context isn't limited to just location.*

Keywords: Mobile Business, mobile advertising, context sensitive mobile applications, data protection.

1. Introduction

Marketing comprises all activities that have to do with acquiring and maintaining markets for a company's products and services. These activities include distribution, product planning, price and communication politics. The most common form of the latter is advertising. Advertising again is defined as the non-personal presentation of ideas, products and services, whereas the identifiable originator has to pay for it (Kotler & Bliemel, 1992). Mobile or wireless advertising is advertising using mobile terminals. While some authors consider also on-board vehicle computers or notebooks as mobile terminals, we restrict ourselves to mobile handheld devices like cellular phones, PDAs and smartphones. Strictly speaking one should use the term "mobile *and* wireless advertising", since "mobile" and "wireless" are orthogonal concepts (Wang, 2003).

There are a couple of reasons why many experts consider mobile advertising as an encouraging branch of mobile business:

- *High penetration rate of mobile terminals.* Mobile terminals – especially cellular phones – are quite popular. According to the International Telecommunication Union (ITU) the worldwide number of mobile phones is far beyond one billion. The average penetration rate in Western Europe is about 83 percent (RegTP, 2003).

- *Mobile terminals are personal communication devices.* People carry their mobile device along most of the day, seldom lend it away and don't share one terminal with other people like one TV-set or one fixed line telephone for the whole family, so mobile advertising can reach people almost anytime and anywhere. Conventional advertising like ads in newspapers or commercials on television can reach people only in certain situations and within certain time spans. During the pre-test for an acceptance study for a mobile service (N=28) we asked the participants "How many hours on an average day is your cellular phone online?" – the mean value of the answers was ≈20,7 hours/day (deviation: 5,1), whereas 56 % answered "24 h".

- *Individually addressable.* Mobile terminals can be addressed individually, so personalized and target-oriented advertising can be realized. Using conventional advertising very often people are reached that aren't interested in the presented product or service.

- *Multimedia capabilities.* Some mobile terminals are able to play back multimedia content, e.g. little movies or jingles. In the future the number of terminals with multimedia capabilities will increase. Also the emerging mobile networks of the 3rd generation like UMTS promise enormous bandwidths for the transmission of such content.

- *Interactive.* Mobile terminals enable interaction. When one receives an ad on his mobile terminals about a service he is interested in, he can immediately request further information or forward the ad to friends.

However there are also some serious challenges when talking about mobile advertising:

- *Spam.* The tremendous amount of spam-messages in e-mail-communication is a big problem. There are studies that state values of far beyond 50 percent for the portion of spam messages, for example (MessageLabs, 2004). A survey recently conducted "[…] indicates that more than 8 in 10 mobile phone users surveyed have received unsolicited messages and are more likely to change their operator than their mobile number to fight the problem […]" (ITU et al., 2005). Spam messages on mobile terminals would be an even bigger problem because of their limited resources due to their size and mobility (bandwidth, battery capacity, memory for storage of messages, computation power). As our mentioned pretest-study implies there are a lot of people who never turn of their cellular phone, so a spam message could even disturb their sleep.

- *Limited user interface.* Mobile terminals have a very limited user interface, e.g. small display, no full real keyboard. Most users aren't willing to enter a lot of data using that limited interface. One way to assist the user when entering data is the usage of context information.

- *Privacy concerns.* Because of the personal nature of mobile terminals privacy concerns are very important for mobile advertising. End users will only provide personal data when data protection is guaranteed. Especially when location based services are able to track the position of users this causes concerns about privacy (Barkhuss & Dey, 2003). Also in most countries there are laws who ask for data protection.

- *Expenses of mobile data communication.* Today the usage of mobile data communication is still very expensive, e.g. about one Euro for 1 Mbyte data traffic when using GPRS or UMTS (prepaid rates are even more expensive), 0.20 Euro for sending a SMS or 0.40 Euro for a MMS in Germany. This prevents many people from using mobile devices for internet research on products and services. Again nobody wants to pay for advertisement, so the advertiser should pay for the data transportation.

The mentioned features and challenges of mobile advertising show an area of conflict: personalized advertising requires sensitive information about the end user, e.g. the end address of his mobile termi-

nal, his fields of interest or his current location. Indeed there are privacy concerns when providing this information for a mobile advertising application.

Within the project "MoMa – Mobile Marketing" we develop a system for providing personalized and context sensitive mobile advertising while guaranteeing data protection.

The rest of this article is organized as follows: in the second chapter we give a short overview about related works concerning mobile advertising. The MoMa-system is introduced in detail in chapter three. The last chapter gives a summary and an outlook.

2. Related Work

The high potential of mobile advertising along with its specific opportunities and challenges is widely accepted in literature, see Barnes (2002), Tähtinen & Salo (2004), Yunos et al. (2003) or Wohlfahrt (2002) for example.

Ads delivered by SMS (Barwise & Strong, 2002) is today's most common form of mobile advertising, e.g. *misteradgood.com* by MindMatics. SMS is very popular – in Germany approximately 20 billion SMS were sent in 2003 (RegTP, 2004) – but the length of the text is limited to 160 characters and images can not be shown, so it should not be the only used channel in a marketing campaign (Dickinger et al, 2004). There are so called "on-pack"-marketing campaigns where consumers can request digital advertising gifts like games, ringtones and logos via SMS (for examples see *12snap.com*).

Another approach for mobile advertising is the distribution of advertisement using multi-hop ad-hoc networks (MANETs), for example "AdPass" (Straub & Heinemann, 2004) or "eNcentive" (Ratsimor et al., 2003). MANETs don't require an installed infrastructure consisting of base stations, cables or routers. If the distance between two mobile terminals is short enough they can establish a peer-to-peer communication (using Bluetooth or WiFi for example) to exchange advertisement messages. This approach is inspired by the idea of word-of-mouth- or viral-marketing (Helm, 2003): an advertising message is spread indirectly by consumers among other consumers, not by the advertiser or an agency. If an ad leads to a purchase the people with terminals that participated in the distribution of that ad may receive a bonus. The advertisers hope to obtain an exponential dissemination of their messages using this way. Also it is assumed that ads received from relatives rather than marketers have a higher credibility. Some systems even provide a monetary incentive for the consumers for receiving advertisement like the above mentioned misteradgood or the one by Zagme (de Reyck & Degraeve, 2003), but entertaining ("advertainment") or informative content can also act as incentive for receiving advertisement (Wohlfahrt, 2002). For MoMa we use the latter approach.

Location Based Services (LBS) use information about the current location of an user to provide information tailored to that location (for example (Cheverst, 2000) as a pioneer-project in that field). Technically this information can be retrieved using a receiver for the signal of the global positioning system (GPS) in a mobile terminal, referring to the location of the nearest base station (cell-of-origin) or even the time difference of arrival of radio signals from several (at least 3) base stations (TDOA). Advertising based on LBS-technology could provide an user with advertisement concerning facilities in the nearer surrounding of his current location and even suggest a route to get there, e.g. Aalto et al (2004), Kölmel & Alexakis (2002) or Ververidis & Polyzos (2002). But LBS are just one (admittedly very prominent) case of context sensitive applications (Schmidt et al., 1999) which use information about the current situation of an user to adapt themselves according to his needs (Schilit et al., 1994). MoMa isn't restricted to location as the only context parameters, some examples of other relevant context parameters will be given below. Because of the special architecture of MoMa there is also the distinction of private and public context parameters, whereas the first are retrieved by the mobile terminal of the user and thus are sensitive with regard to privacy.

A very important concept in mobile advertising due to the experience with unsolicited direct advertising – especially spam-e-mails – is permission marketing (Godin, 1999, Krishnamurthy, 2001): consumers will only receive ads after they have explicitly opted-in and they can opt-out anytime if they no longer want to receive advertisement.

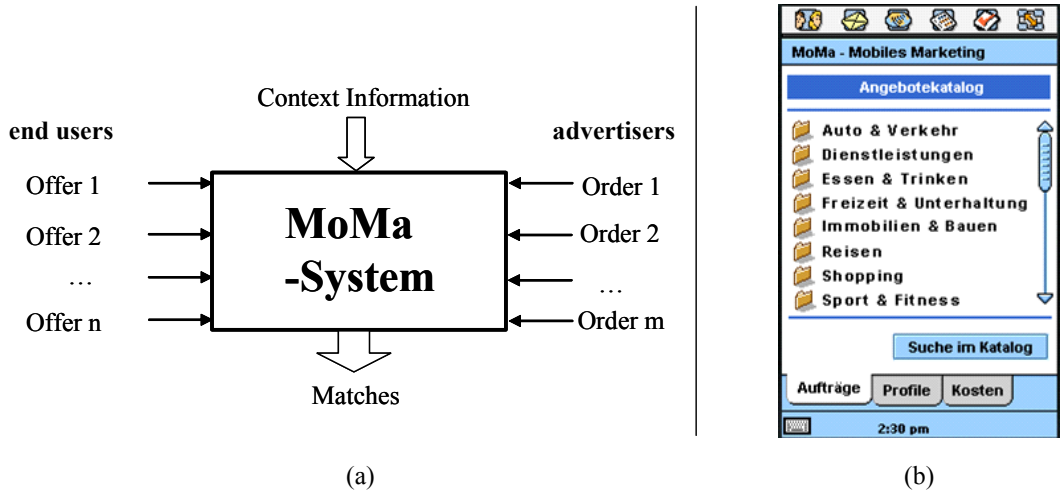
3. The MoMa-system

3.1. Overview

The basic principle of the MoMa-system is illustrated in figure 1a: The end users create so called orders according to a given catalogue, a hierarchical ordered set of possible product- and service-offers which are described by appropriate attributes: on the uppermost level we may have "gastronomy" for example, which could subsume categories like "pubs", "restaurants" or "catering services". Each category is specified by certain attributes, in the gastronomy-example this could be "price level" and "style". When creating an order the client application will automatically fill in appropriate context parameters, which would be "location", "weather" and "time" in the given example: the gastronomy facility shouldn't be too far away from the current location of the user, beer gardens shouldn't be recommended if it's raining and the facility should be open.

On the other side the advertisers put offers into the MoMa-system. These offers are also formulated according to the catalogue. When the system detects a pair of a matching order and offer the end user is notified the way he specified (SMS to a given mobile phone number, e-mail, text-to-speech-call). He then can decide if he wants to contact the advertiser to accept that offer, but this is beyond the scope of MoMa (as it is for the most advertising approaches).

Figure 1b is a screenshot of the MoMa-client application for Symbian OS, but there are also implementations for J2ME-Devices and Desktop-PCs.



(a) (b)

Fig. 1. Principle of the MoMa-system (a) and screenshot of consumer client-application on Symbian OS (b)

3.2. System details

Each end user of the MoMa-system (see figure 2) has an unique user-id and at least one general and one notification profile. The general profile contains information concerning the user which could be rele-

vant for the creation of an order, e.g. age, family status, fields of interest. Additional general profiles are possible, e.g. one where his family status isn't mentioned. A notification profile describes how (SMS/MMS, e-mail, text-to-speech, etc.) an user wants to be notified when an offer matching one of his orders is found; this notification mode can depend on the current time, e.g. no text-to-speech-calls to phone number A from 9 p.m. till 8 a.m., send SMS or e-Mail instead. The instances of both kinds of profiles can be stored on a server of the anonymization service, so they can be used on different terminals of an user. Only the notification profiles have to be readable by the anonymization service, the general profiles can be encrypted in a way only the user can decrypt them.

For the creation of an order X the user chooses one of his general and notification profiles each and specifies what kind of product or service he is interested in using the categories and attributes of the catalogue. In doing so single attribute values will be looked up automatically in the chosen general profile respective the available private context parameters if applicable, for example the current location. It is important to note that the order X itself contains no declaration about the identity or end addresses of the user, but may contain private context information. Afterwards the user-ID, the index of the chosen notification profile and a randomly generated bit string are put together and encrypted, the resulting cipher text be denoted with C. For the architecture it doesn't matter if a symmetric or asymmetric encryption algorithm is used. Symmetric encryption is favorable in terms of the computation power needed (Schneier, 1996) which may be limited on a mobile device, but requires a secure channel for the initial exchange of the key. The piece of random data is included to make sure that a different C is calculated each time when an end user posts several orders to the system using the same notification profile.

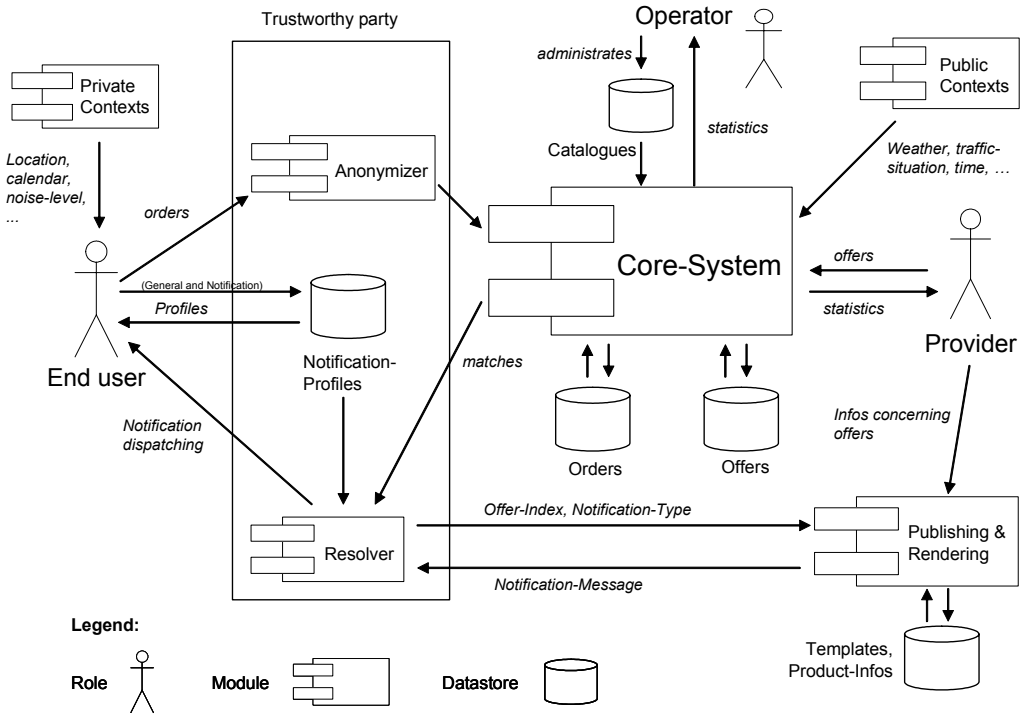


Fig. 2. Architecture of the MoMa-system

The pair {X,C} is sent to the anonymizer which forwards it to the core system. This loop way ensures the MoMa-operator cannot retrieve the IP- or MSISDN-address of the order's originator. Should a private context parameter change while an order is active (e.g. new location of user) the updated X' along with the old C will be send to the core server, where the old order X can be looked up by C and be replaced with X'. An order may also have a date of expiration or expire automatically after a given number of notifications were dispatched to the end user.

The advertiser defines his offer Y using the catalogue and transmits it to the MoMa-server directly. Furthermore he deposits different templates for the notification of end users on the publishing & rendering-server.

Triggered by events like new or updated orders and offers or changed public context parameters the MoMa-server tries to find matching pairs of orders and offers. For each match {{X,C}, Y} found C along with the ID of Y will be sent to the resolver-component of the trustworthy party. Here C is decrypted so the notification profile can be looked up to request the needed notification message from the publishing-server. This message will be dispatched to the given end address by the resolver.

The advertisers don't have access to the personal data of the end users or a component of the whole system where such data is stored, especially they cannot find out about the end addresses to send unsolicited messages. Even the operator of MoMa only sees the cipher text C, which could be considered as a transaction- or "one time"- pseudonym, the most "anonymous" form of pseudonymity (Pfitzmann & Köhntopp, 2000); one transaction may consist of several operations, like updating an order X when there are changes of parameters of the private context or removing it. Other forms of pseudonyms like role-pseudonyms (used for one specific usage scenario like internet shopping), relationship-pseudonyms (used for one specific communication partner) or role-relationship-pseudonyms are used more often than just for one transaction and hence have a higher chance of being revealed.

If there already is a matching offer in the database, the user gets immediately an answer, so we could consider this as pull-advertisement; if the matching order is entered into the system after the offer, the notification of the user is a push-advertisement. Using context information the client can amend the orders in a *smart* way, so we denote MoMa as *combined smart push & pull-approach*.

Special user support for a mobile application is essential due to the limited usability of mobile terminals: Thus MoMa offers the usage of context information and of general and notification profiles. The profiles can be uploaded to a server of the trustworthy party to synchronize them to different mobile terminals of the user. On the publishing & rendering-server notification-templates for different kinds of mobile terminals can be stored. There is also a PC-version of the client-software, because in some situations (especially the initial creation of the profiles) it may be more convenient for the user to use a "real" computer.

3.3. Public and private context

The special architecture of MoMa with regard to privacy concerns requires the distinction of public and private context information:

- ***Private context parameters:*** Parameters of private context are retrieved by the mobile terminal and its sensors or the mobile terminal is at least involved. Thus private context parameters can not be retrieved anonymously but they can be processed anonymously.
  Examples: position, background noise level, temperature, calendar, available technical resources like display size or speed of CPU.
- ***Public context:*** This context information can be retrieved without knowledge about the identity of the respective user.
  Examples: weather, traffic jams, results of sport events, time or date.

For the reasonable processing of some parameters of the public context it might be necessary to know about certain private context parameters. The weather in a given city is a parameter of the public context, but one has to know the location of the user to look up the weather of the right city.

3.4. Abuse of anonymity

Systems which provide anonymity in a way are often confronted with the accusation of supporting illegal activities (e.g. (heise, 2001)). In the case of a platform for mobile advertising one could think about the initiation of trade with illegal goods, e.g. drugs or weapons. Since orders and offers of the described platform have to be formulated in terms of the given catalogue the operator simply won't setup categories for such goods.
To circumvent that constraint some users could establish codenames for banned offers, e.g. "pizza with anchovy" for a certain illegal substance. Since the marketers have to register for the billing it would be easy to identify the originator of an unlawful offer.

3.5. Business model for MoMa

There are six roles within the business model of MoMa (for a discussion on the concept of business models see (Timmers, 1998)): Advertiser, operator, provider of context-information, mobile network operator, trusted party and end user. In figure 3 the flows of information and data between the different parties of the business model are depicted; for the sake of clarity the mobile network operator is omitted.

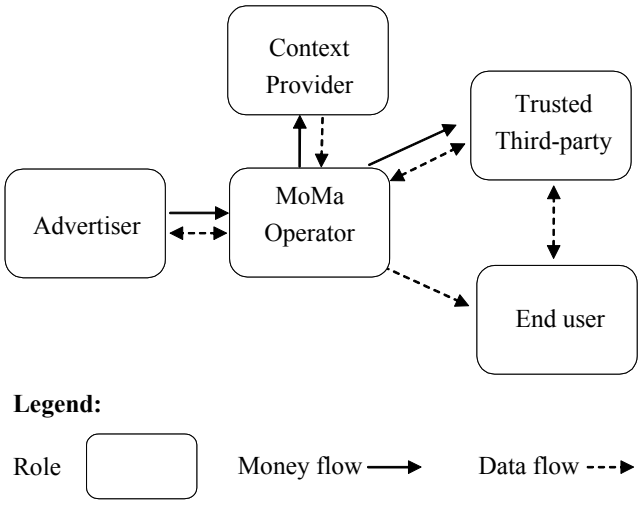


Fig. 3. A business model for MoMa

The end users are not charged for using MoMa, but they have to pay the fee for the transferred data volume to their network provider when submitting an order. Since the data volume generate by one order is less than one Kbyte these costs are almost negligible. The data flow depicted by the arc from the MoMa to the end user occurs when downloading the client application and new catalogue information.

On the other side of the system the advertisers have to pay for each contact generated by MoMa. The price of one contact depends on the kind of product or service: one contact for a "lunch"-advertising won't be as expensive as a contact for an ad concerning real estates. Depending on the volume of traffic for a category the price can be adjusted. As additional source of revenue the MoMa-operator could sell statistical analyses concerning the pattern of demand of the end users.

The trustworthy party and the context providers are paid by the MoMa-operator. But it is also thinkable that the trustworthy party is compensated by end users (if people are willing to pay for the protection of their personal data) or is a public institution paid by the state.

When introducing a system like MoMa there is the well known "hen-and-egg" problem of how to obtain the critical mass of advertisers and end users: without a certain number of advertisers there won't be enough interesting offers but without offers the system isn't interesting for end users. In turn without end user MoMa is not interesting for advertisers. To overcome this vicious circle there is the possibility of automatically putting offers of well-established eCommerce-platform into the system without charging them. Since many of those platforms offer webservice-interfaces this can be achieved without much effort.

4. Summary and outlook

We discussed the special features and challenges of mobile advertising with emphasis on privacy problems. The introduced MoMa-system acts as mediator between advertisers and end user. Latter can define orders for free, while the advertisers have to pay for each contact. Because of the highly personalized nature of the advertisement provided by MoMa and the practical impossibility of receiving spam we hope the advertisement provided won't be perceived as advertisement, but as valuable information. Furthermore the architecture enables personalization using context information while privacy can be guaranteed. We will evaluate the system using the approach for an acceptance model suggested by (Amberg et al., 2004). Also we will try to identify a set of criteria for the comparison of different approaches or system for mobile advertising.
The industry-partners of the MoMa-consortium plan to utilize the results of the project for a mobile fan guide concerning the soccer world championship in 2006.

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