# ADVERTISING VIA MOBILE TERMINALS
## *Delivering context sensitive and personalized advertising while guaranteeing privacy*

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Abstract: Mobile terminals like cellular phones and PDAs are a promising target platform for mobile advertising: The devices are widely spread, are able to present interactive multimedia content and offer as almost permanently carried along personal communication devices a high degree of reachability. But particular because of the latter feature it is important to pay great attention to privacy aspects and avoidance of spam-messages when designing an application for mobile advertising. Furthermore the limited user interface of mobile devices is a special challenge. The following article describes the solution approach for mobile advertising developed within the project MoMa, which was funded by the Federal Ministry of Economics and Labour of Germany (BMWA). MoMa enables highly personalized and context sensitive mobile advertising while guaranteeing data protection. To achieve this we have to distinguish public and private context information.

## 1 INTRODUCTION

Advertising is defined as the non personal presentation of ideas, product and services whereas someone has to pay (Kotler & Bliemel, 1992). Mobile or wireless[1] advertising uses mobile terminals likes cellular phones and PDAs.

There are a couple of reasons why mobile terminals are an interesting target for advertising:

- There are quite a lot of them: In Germany there are more than 64 million cellular phones, a number that exceeds that of fixed line telephones. The average penetration rate of mobile phones in Western Europe is about 83 percent (RegTP, 2004), estimates for the worldwide number of cellular phones are far beyond one billion according to the International Telecommunication Union (ITU).
- Mobile terminals are devices for personal communication, so people carry such devices with them most of the day which leads to a high reachability of up to 14 hours a day (Sokolov, 2004). Conventional advertising can reach its audience only in certain timespans and situations (e.g. TV commercials reach people when they are sitting in their living room after work, newspaper ads are usually read at breakfast time), but mobile advertising can reach people almost anywhere and anytime.
- Since each mobile terminal can be addressed individually it is possible to realise target-oriented and personalized advertising. Most conventional advertising methods inevitably reach people not interested in the advertised product or service.
- Mobile devices enable interaction. When one receives an ad on his mobile terminal he can immediately request further information or forward it to friends.

[1] Most authors use „wireless“ and „mobile“ as synonyms which is strictly considered incorrect since wireless and mobile are orthogonal concepts (Wang, 2003). “Mobile advertising” can also denote advertising on a mobile surface (e.g. bus, aeroplane, train), but we don’t use the term that way.



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- In the future most mobile devices will be capable of presenting multimedia-content, e.g. little images, movies or music sequences. This is important if logos and jingles associated with a certain brand have to be presented.
- The emerging mobile networks of the third generation (e.g. UMTS) will provide enormous bandwidths, so that until nowadays unthinkable mobile services will be possible.

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

- Because of the permanently increasing portion of spam-mail on the internet — statistics state values far beyond 50 % (MessageLabs, 2004) — there is the concern of this trend spilling over to mobile networks. 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 […]" (International Telecommunication Union, 2005). Spam-messages in mobile networks are a much more critical problem, since mobile terminals have relatively limited resources (bandwidth, memory for storage of messages, computation power).
- The user of a mobile advertising application will only provide personal data (e.g. age, marital status, fields of interest) if data protection is warranted. Especially when location based services are able to track the position of users this causes concerns about privacy (Barkhuss & Dey, 2003).
- Usability: Because of their small size mobile terminals have a limited user interface, like small displays or no full-blown keyboard. Thus a mobile application should demand as few user entries as possible. But the small display can be also considered as advantage: only the text of the advertisement will be displayed, nothing else will distract the user.
- Expenses of mobile data transmission: 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, 0.20 Euro for sending a SMS or 0.40 Euro for a MMS). This hinders 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.

Within the project „Mobile Marketing (MoMa)" we developed a system for mobile advertising which takes all of the mentioned problems into account and makes highly personalized advertising possible while guaranteeing data protection.

The rest of this article is organized as follows: the second chapter deals with related work. In chapter three we describe the functionality, architecture and business model of the MoMa-system. Afterwards we discuss the different types of context information in chapter four, before a summary in the last chapter is given.

# 2 RELATED WORK

## 1.1 2.1 Mobile Advertising

The high potential of mobile advertising along with its specific opportunities and challenges is widely accepted in literature, see Barnes (2002), Tähtinen & Salo (2004) or Yunos, Gao & Shim (2003) for example. The latter article also discusses the business models for mobile advertising by vendors like Vindigo, SkyGo and AvantGo.

Today's most common form of mobile advertising is the delivery of ads via SMS (Barwise & Strong, 2002), e.g. misteradgood.com by MindMatics. SMS is very popular – in Germany approximately 20 billion SMS were sent in 2003 (RegTP, 2003) – but the length of the text is limited to 160 characters and images can't be shown, so it shouldn't be the only used channel in a marketing campaign (Dickinger et al., 2004).

Other more academic approaches for mobile advertising are the distribution of advertisement using multi-hop ad-hoc networks (Straub & Heinemann, 2004, Ratsimor, 2003) or location aware advertising using Bluetooth positioning (Aalto et al, 2004). There is also the idea of advertising using wearable computing (Randell & Muller, 2000).

Some systems even provide a monetary incentive to the consumers for receiving advertisement like the above mentioned misteradgood or the one described by de Reyck & Degraeve (2003).

A very important concept in mobile advertising due to the experience with spam-e-mails is permission marketing (Godin, 1999): consumers will only receive ads after they have explicitly opted-in and they can opt-out anytime. Because a consumer has to know a firm before he can opt-in it might be necessary to advertise for a mobile advertising campaign, see the three case studies in Bauer et al. (2005) for example.

## 1.2 Context sensitive mobile applications

The term context with regard to mobile applications was introduced by Schilit, Adams & Want (1994) and means a set of information to describe the current situation of an user. A context sensitive application makes use of this information to adapt to the needs of the user. For mobile applications this is especially important, since the terminals have a limited interface to the user.

The most often cited example of context sensitive applications are location based services (LBS): Depending on the current position the user is provided with information concerning his environment, e.g. a tourist guide with comments about the sights in the surrounding area (Cheverst, 2000). Technically this location context could be detected using a GPS-receiver or the position of the used base station (cell-ID).

But there are far more kinds of context information than just location, see Schmidt, Beigl & Gellersen (1999) or chapter four of this article for example.

Other kinds of thinkable context sensitive services depend on profile information. These profiles can be retrieved with explicit support by the user (active profiling) or when analysing earlier sessions (passive profiling). Active profiling could be implemented using a questionnaire, passive profiling could apply data mining methods. Active profiling means some work for the end user but is completely transparent to him. Moreover not all relevant information can be retrieved with the needed accuracy using passive profiling, e.g. the age of a person.

## 1.3 Empirical Results

Based on a survey (N=1028) Bauer et al. (2004) tried to figure out the factors important for consumer-acceptance of mobile advertising. Their results indicate that the personal attitude is important for the user acceptance of mobile advertising campaigns. This attitude is mainly influenced by the perceived entertaining and informative utility of adverts, further also by social norms. “Knowledge concerning mobile communication” and “attitude towards advertising” didn’t show a strong effect.

Another survey conducted by Bauer et al. (2005) was aimed at executives responsible for marketing (N=101). More than one half already had experience with mobile advertising campaigns, over 50 % of those who didn’t intended to use the mobile channel for advertising in the future. As most important advantages “direct contact to customers” (87 %), “ubiquity” (87 %), “innovation” (74 %), “interactivity” (67 %) and “viral effects” (38 %) were considered. As disadvantages “high effort for implementation” (59 %), “limited creativity” (56 %), “untrustworthy” (43 %), “target group can’t be reached” (11 %) and “lack of consumer acceptance” (8 %) were mentioned.

An often cited empirical study in the field of mobile advertising is the one conducted by Barwise & Strong (2002): one thousand people aged 16-30 were chosen randomly and received SMS-adverts during a trial which lasted for 6 weeks. The results are very encouraging: 80 % of the test persons didn’t delete the adverts before reading them, 74 % read at least three quarters of them, 77 % read them immediately after reception. Some adverts included competitions which generated an average response rate of 13 %. There was even a competition where 41 % of those who responded did so within the first minute. Surprisingly 17 % of test persons forwarded one or more text adverts to a third party, which wasn’t intended by the research design. Another result is that respondents felt that receiving three text messages a day was “about right”.

# 3 DESCRIPTION OF THE MOMA-SYSTEM

## 1.4 Overview

The basic principle of the MoMa-system is illustrated in figure 1: The end users create orders according to a given catalogue whereas the client software automatically queries needed context parameters. The catalogue (see figure 2 for a screenshot) is a hierarchical ordered set of possible product and service-offers which are described by appropriate attributes: on the uppermost level we may have “travelling“, “sport & fitness” or ”gastronomy” for example, whereas the latter 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, e.g. “location” and “weather”: the gastronomy facility shouldn’t be too far away from the current location of the user and beer gardens shouldn’t be recommended if it’s raining.

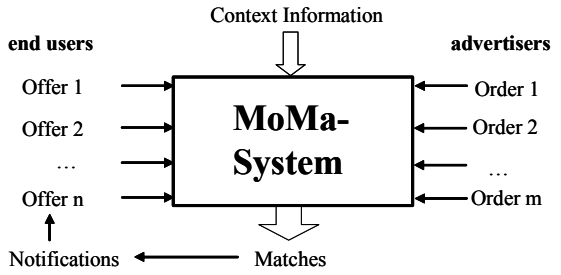


Figure 1: Basic principle of the MoMa-system

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. Then he can decide if he wants to contact the advertiser to call upon the offer, but this is beyond the scope of the MoMa-system.


Figure 2: Screenshot of client application on Symbian OS (catalogue view)

The end user only gets advertising messages when he explicitly wants to be informed about orders matching certain criterions. He is anonymous with regard to the advertisers as long as he doesn't decide to contact them. The later described architecture of the system supports the employment of a trust third-party as mediator between end users and MoMa, so even transaction-pseudonymity with regard to the operator of MoMa can be achieved.

## 1.5 Business model

The flows of money and information between the different roles within the business model of MoMa are depicted in figure 3. The roles are: advertiser, MoMa-operator, context-provider, mobile network operator, trusted party and end user.

For the end user MoMa is free, he only has to pay his network provider for the transferred data when he submits an order to the system. Since the data volume generated when sending one order is less than 1 Kbyte, these costs are almost negligible. On the other side the advertisers only have to pay for actual contacts. The price for one contact depends on the used category of the catalogue, for example one contact of the category "real estate" may be more expensive than a "lunch break"-contact. If the number of "lunch break"-offers should explode, the price for that category could be adjusted. The price for one contact has at least to cover the communication-costs for the notification of the end user.

Another source of revenue for the MoMa-operator is providing statistical analyses about what kind of products and services the users of the MoMa-system are interested in. The MoMa-operator has to pay for the services of the trustworthy party and the context-providers.

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 MoMa isn't interesting for end users. However without many end users MoMa isn't interesting for advertisers. To overcome this problem there is the possibility of automatically putting offers from well-established eCommerce-platforms into the system without charging the operators of those platforms. Since many of them offer a webservice-interface this can be achieved without much effort.

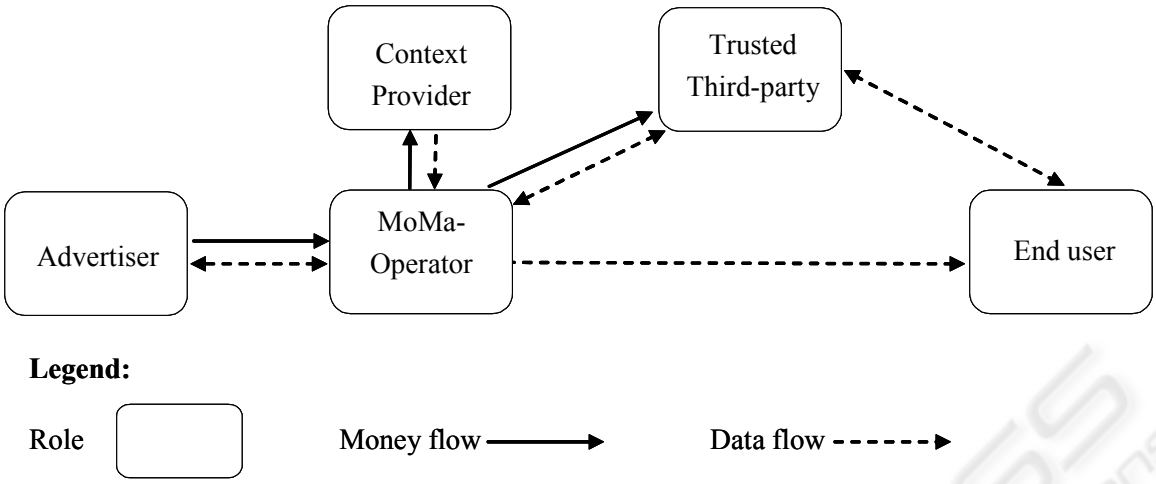


Figure 3: Money and data flows of the MoMa-business model

## 1.6 Architecture and technical details

Each end user of the MoMa-system (see figure 4) 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 relevant for the creation of an order, e.g. age, family status, fields of interest. 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. text-to-speech-calls to phone number A from 9 a.m. till 16 p.m. and to phone-number B from 16 p.m. till 20 p.m., send e-mail-message else. 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 for 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 profile each and specifies what he desires 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. Please note: the order X itself contains no declaration about the identity or end addresses of the user. The user-ID, the index of the chosen notification profile and a randomly generated bit string are put together and encrypted[2], the resulting cipher text be denoted with C. 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'.

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

Triggered by events like new/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 from the publishing-server. This message will be dispatched to the given end address.

If there is already a matching offer in the database, the users immediately gets an answer, so we could consider this as pull-advertisement; if the matching order enters the system after the offer, the notification of the user is a push-advertisement.

[2] For the architecture it doesn't matter if a symmetric or asymmetric encryption algorithm is used. Symmetric encryption is favourable in terms of the needed computation power (which may be limited on a mobile device), but requires a secure channel for the initial exchange of the key.

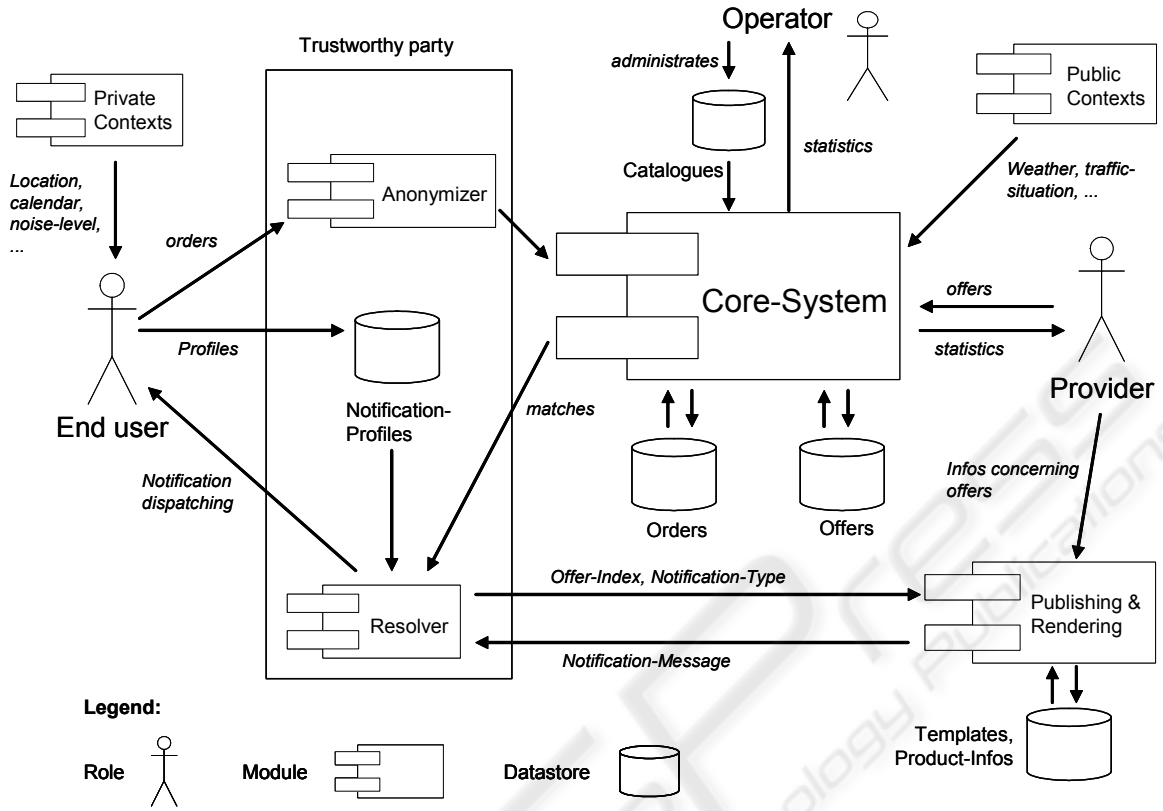


Figure 4: Architecture of the MoMa-system

Using context information we can amend the orders in a "smart" way, so MoMa can be denoted as *combined smart push & pull approach*.

The advertisers don't have access to the personal data of the end users, in particular they can't find out about the end addresses to send unsolicited messages and have no physical access to components of the system where addresses are stored. Even the operator of MoMa only sees the cipher text C. This ciphertext C is different for each order, even if two orders have the same user ID and use the same notification profile, because of the random information included. Thus C can be considered as transaction pseudonym, which is the most secure level of pseudonymity (Pfitzmann & Köhntopp, 2000)[3].

[3] Transaction pseudonyms are more secure than other kinds of pseudonyms (relation or role pseudonyms, personal pseudonyms), since it is less likely that the identity (or end address) of the user behind a pseudonym is revealed.

# 4 DIFFERENT CLASSES OF CONTEXT INFORMATION

The anonymization of the orders requires the distinction between public and private context information (see columns $c_{i1}$, $c_{i2}$ in table 1):

- Private context parameters are retrieved by the mobile terminal and its sensors or the mobile terminal is at least involved. Thus private context parameters can't 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 information can be retrieved without knowledge about the identity of the respective user. Examples: weather, traffic jams, rates at the stock exchange.

For the reasonable processing of some parameters of the public context it might be necessary to know about certain private context parameters, e.g. the weather in a given city is a public context parameter, but one has to know the

location of the user to look up the weather in the right city.

Furthermore context parameters can be characterised by different degrees of variability (rows $c_{1j}$, $c_{2j}$, $c_{3j}$ in table 1):

- Static context parameters have never or very seldom to be updated. Examples: gender or mother-tongue.
- Semistatic context parameters changes have to be updated but not very often (several weeks or years). Examples: age, family status.
- Dynamical context parameters change often or even permanently. Example: current location of a user, surrounding noise level.

Table 1: Different classes of context

| Context dimension $c_{ij}$ (examples) | public $c_{i1}$ | private $c_{i2}$ |
|---|---|---|
| $c_{1j}$ Static | **$c_{11}$** (currency, timestamp format, frequency of radio access network) | **$c_{12}$** (gender, date of birth) |
| $c_{2j}$ Semistatic | **$c_{21}$** (season, bathing season) | **$c_{22}$** (salary, job, number of kids) |
| $c_{3j}$ Dynamic | **$c_{31}$** (weather, traffic situation, delayed train) | **$c_{32}$** (location, display size, surrounding noise level) |

When combining these two classification schemes we obtain the six classes shown in table 1. Based upon these six classes we can give statements how to retrieve the respective context parameters:

- Public static context parameters ($c_{11}$) will be determined via configuration when installing a MoMa-System.
- Public semistatic context parameters ($c_{21}$) will be set manually by the MoMa-operator or derived from rules depending on the date if applicable.
- Public dynamic context parameters ($c_{31}$) will be queried by the MoMa-operator from special context providers.
- Private static and semistatic parameters ($c_{12}$, $c_{22}$) have to be determined using active profiling. According to their definition these parameters change never or very seldom so it isn't much work for the end user to keep them up to date.
- The parameters of the private dynamic context ($c_{32}$) have to be determined for each order by the mobile terminal of the end user.

# 5 SUMMARY

The presented system in this article enables context sensitive mobile advertising while guaranteeing a high level of privacy. To achieve this, the distinction of private and public context parameters is necessary. An end user will only receive personalized offers when he defines orders so there is no danger of spamming. The costs for the transmission of the ads are covered by the MoMa-operator respective the advertisers. Since mobile terminals have a limited user interface the MoMa-client-application is designed in a context sensitive manner to assist the end user. There are also different kinds of profiles to support the usability.

The industry-partners of the MoMa-consortium plan to utilize the results of the project within the scope of the Soccer World Championship 2006.

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