# EMPLOYING THE C2C PRINCIPLE FOR MAKING THE USE OF DATA SERVICES ON MOBILE PHONES MORE ATTRACTIVE

***About the introduction of customer-to-customer services***

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Keywords: Wireless data services, Personalization, Wireless Internet access, Handheld devices, QoI, C2C

Abstract: Today, digital mobile phones are still rarely applied for accessing and using data services. Due to their broad distribution, mobile phones would offer a very attractive platform for information retrieval in different areas, like, e.g., traffic channels, public transportation, sports, and many others. Unfortunately, there are limitations, which prevent the average customer from widely using these services: At first, the costs for data transfers through wireless digital phone networks are extremely high, and on the other hand, the handling of the devices usually is very uncomfortable. Here, a new system concept is described, which aims to overcome the before described limitations: In this design, a central service belonging to an individual customer sources the desired information, e.g. from the open Internet, and prepares it for an efficient wireless transfer. Through the second part, i.e. the terminal display software running on the mobile device, the user can retrieve and inspect this information with minimal efforts, because it is automatically transferred from the sourcing service. On base of this construction, the user interface is simplified, the data access costs are reduced, and finally the information access speed can be increased. In this approach, customised information is retrieved through a central client belonging to the customer, and hence, this construction shall be called C2C (customer-to-customer) service.

## 1 INTRODUCTION

The acceptance level for data services accessed from digital mobile phones appears much lower than what was forecasted during the introduction of these services several years ago. For instance, at the moment in Germany below 5% of the phone owners are using data services at all. Besides psychological reasons (e.g., unawareness), which could be overcome by advertisement and marketing campaigns, there arise two hard problem fields, which prevent the average customer from extensively using data services through digital wireless networks:

**1. Costs:** The expense for wireless data transfers through phone networks is much more expensive than through landline networks. Typically, this ratio ranges in the order of $10^4$, and in addition to that, the wireless data access rate is considerably lower. Hence, compared to alternative but related technologies (e.g., ADSL), the user has to pay much more for a much weaker service.

**2. Usability:** The comfort of handling small devices like mobile phones appears at the moment as very limited. Clearly, there are physical limitations of the devices like small display screens, and keypads with only digits and some control keys, but these properties are inherent and partially intended, because these devices should be lightweight, small, and should provide long operation time with each battery charge. In consequence, user interfaces have to be designed for meeting these restrictions (Johnson, 1998). For instance, WAP navigation (www.wapforum.org) was directly inherited from the idea of WEB navigation on desktop computers or workstations. The identical use paradigm is applied in WAP browsing, although the display device class is completely different. Therefore, one cannot consider the fact as surprise that the common user does not extremely favour WAP browsing, because it requires continuous tree-based navigation control, which has to be performed with the help of a fractional keyboard.

From these discussion points, two main approaches for an optimization of wireless data access systems used from mobile phones directly

Weghorn H. (2004).
EMPLOYING THE C2C PRINCIPLE FOR MAKING THE USE OF DATA SERVICES ON MOBILE PHONES MORE ATTRACTIVE - About the introduction of customer-to-customer services.
In *Proceedings of the First International Conference on E-Business and Telecommunication Networks*, pages 3-7

can be deducted: **1.** Reduction of the access costs, and **2.** Optimisation of the user handling (UI)

# 2 CONCEPT OF CUSTOMISED SERVICES

## 2.1 Fundamental approach

The first important goal is to reduce the data transfer costs of the wireless access, and this obviously can only be achieved, if the transferred data amount during external communication on the mobile terminal is minimized.

Considering, e.g., a traffic information system, which tells the customer, whether there is a traffic jam on a certain highway or not, the content information can be described by one bit (yes/no). In other words, it is sufficient that the mobile device loads only this single bit of information through the wireless link from an external service (which still has to be defined at this point). In contradiction to this approach, generalized mechanisms like WAP browsing would require the user to navigate through a WAP page tree, which consists of a set of pages. All these WAP pages will accumulate to a total data size, which has to be transferred and paid for, and which – due to the XML based coding scheme (Bradley, 1998) of WAP contents – will be much bigger than this truly required information amount.

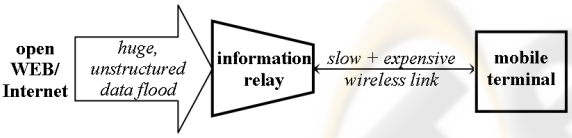


Figure 1: An intermediate information relay translates the huge data amounts on the open WEB for an efficient wireless transfer

For properly handling this kind of information input, the display software needs specific knowledge about the information retrieval. In addition, a specific service outside the terminal is required to deliver exactly this coding (Fig. 1). Parameters have to be supplied for an operation of the information service in a manner that it truly can be useful for the customer: For the traffic channel example, an important parameter is the targeted highway. For flexibility, the user on the mobile terminal has to be able to select the highway, and hence this parameter has to be communicated to the information service.

Another question to be answered is how the information service will source its input. For many application cases, e.g. timetable information on flights, railways, the information can be sourced from the open Internet, in particular from the WEB. For the traffic channel sample many public radio stations present themselves in WEB sites on the Internet, and they are providing recent traffic information as part of their daily business. With this, the information relay service in Fig. 1 better is described as intermediate mining agent, which particularly is constructed according to the given problem.

Hence, the tasks for the intermediate service can be summarised:

- Collect source information from different sites on the Internet (or other appropriate sources)
- Extract the targeted information contents
- Prepare the information packet for minimal data transfer
- Supply the required control structures for the remote access from the mobile device

Discussing next the second important goal – achieving a comfortable handling on the mobile terminal: For this, personalization can act as solution key. In particular, a comfortable handling is achieved, if the user just has to supply only one single or a few input actions before receiving the desired response output (e.g. by launching the query with a hot key press on the terminal). The information system has to know, without asking for an explicit input of this, the parameters of the information query.

The question to be answered then is, how these parameters are determined. There are different possible answers: A first straightforward approach is to make these parameters configurable by the user. In this case, the terminal software has to be broken down into to two parts (Fig. 2): One part for entering the parameters (e.g., for an e-mail retrieval system the account information, and the server settings), which intrinsically will be uncomfortable, but which will be rarely used. And the second part is intended for daily use, because it launches efficiently the desired information query. The alternative for the construction of the configuration part would be a self-learning system, which asks during the first invocation for the querying parameters, and after this automatically generates hot lists, which can be manually modified / edited / extended by the user.

This kind of parametrization is commonly called personalization and it is especially feasible for small mobile devices, because these units are usually owned and used by only one person. Personalization is the key for achieving the initial demanded simplifications of the user handling.

According to the so far described structure, the Internet relay software, and the terminal display software have to be closely related. Since this kind of system delivers customised information contents by software units belonging to the customer

him/herself, this kind of construction shall be called a C2C system. This does not exclude that the Internet relay can be used by other users (= customers). For instance students, who want to share studying course information, may use such a tool, but this application sample even more manifests the term C2C ("one customer to many") as possible variant, which shows also the close relation to the meanwhile common terms of B2C and B2B, for which a company (business) delivers a service.

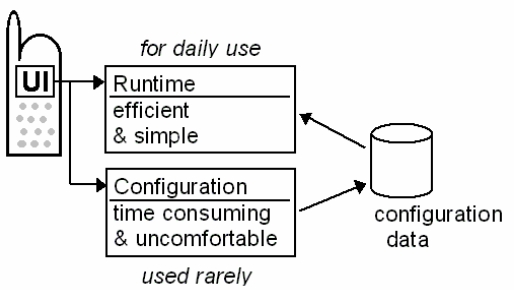


Figure 2: Two parts of the terminal software.

## 2.2 QoI = QoS measure for information contents

The open Internet, in particular the WEB, can be used as information mine for many purposes, as also for the before described information systems with mobile terminals. Today, many people collect information from the WEB, but in most cases they are not aware of the quality of the retrieved content. For instance traffic information systems often do not supply the full or accurate information, in many cases the messages are outdated. Various reasons can be identified for problems with the quality of information, for which a new term should be introduced here: **QoI** (quality of information) shall represent an indicator similar to the term QoS, which is commonly used in networking environments.

The reasons for low QoI values are distinct: As one sample, traffic channels are often operated by the help of non-professional personal drivers, who deliver their observations by phone call: In this chain there are a couple of error sources.

In contradiction to such system immanent problems, there exist also samples of intentional misinformation: For the northern region of the Alps, it can be traced that certain skiing regions update their online information (WEB cam pictures, weather conditions) only if these are attractive. If the conditions are low, the WEB contents simply are not updated.

Since the C2C system employs an intermediate gateway for achieving best performance, this intermediate unit can additionally be used for measuring the QoI of the desired content. In some cases this can be obtained by checking the consistency from the same WEB site (e. g., sample on train departure information in [Weghorn, 2004-1]), in other cases this may be obtained by sourcing different independent WEB sites providing the same information contents (e. g. on traffic channels in a certain country region, compare sample in [Weghorn, 2004-2]).

## 2.3 Discussion of the C2C relay

Summarising the design approach, the C2C information utility can be considered as one unique software unit. Internally it is constructed as distributed system in an asymmetric manner: All the information sourcing efforts as also the sourcing intelligence are inside the Internet relay part. By that, minimal software can be achieved on the terminal device, which is intended for an efficient and appropriate user interfacing (input controls and presentation of contents).

Mediator and wrapper systems, which deal with the transfer of Internet based information to mobile terminals, were reported earlier (Mahmoud, 2002; Wang, 2003). Also the idea of size-efficiently transferring WEB contents to wireless terminals was discussed already (Weghorn, 2002), but in contradiction to these considerations, the approach here goes much further by adding considerable intelligence to the intermediate instance, specifically the multi-sourcing and the measuring of QoI. Particularly coding the intermediate result for a highly efficient wireless transfer can also not be compared to the standard compression of generalised formats (like, e.g., WAP pages).

## 2.4 Alternatives to WEB accesses for electronic data sourcing

The WEB offers a valuable source for information systems, but it should be considered that this not always is the original access. Traffic information again yields samples for an alternative electronic access to the information contents: Traffic channels traditionally are broadcasted by public radio stations, and the RDS system (radio digital system exchanges these text-based messages in parallel to the analogue audio signal through the same radio frequency air link) can be used for accessing this information. Practically, this can be achieved by installing a plug-in radio receiver in a computer (e.g., PC-similar system), and operating a scanner on defined stations for retrieving the various traffic messages. From

there, these messages can be forwarded to the C2C relay.

As other example, airports traditionally publish the departure and arrival tables through public TV, through the so-called teletext (or video text) contained especially in regional TV broadcast channels. These can be accessed electronically by a RF receiver unit, which is plugged into a computer. This kind of extension hardware is also available since many years on the consumer market.

Hence, for certain information systems, the WEB mining may replaced or combined with alternative methods, but these will again require a very specific solution for the addressed problem.

# 3 TECHNICAL POSSIBILITIES FOR IMPLEMENTATIONS AND C2C SAMPLE SYSTEMS

For implementing the C2C Internet relay, common WEB technologies can be applied. These are scripting languages like Perl or PHP, or compiled languages like JAVA servlets (Bell, and Parr, 2002).

Developing software for mobile terminals like GSM phones, long time was restricted to the device manufactures themselves. Fortunately, a couple of years ago Sun company came up with the approach to bring JAVA development to these small devices (which was the original aim for the introduction of the JAVA language), and a reduced JAVA version was defined, which was named JAVA micro edition (= J2ME), and which was intended for devices with low resources in respect to CPU computing power and memory (Piroumian, 2002). Hence, one possibility today for implementing the described terminal software is to use J2ME, especially because it was defined with HTTP networking capabilities (Knudsen, 2002) from its first definition.

Recently, devices from different manufactures were introduced, which are based on the open operating system Symbian (www.symbian.com). Hence, it is today also possible to develop terminal software with other standard programming languages, like, e.g., C++, for a series of different terminal devices.

In the second year of our studying course for applied computer science, J2ME was offered as one of the selectionable lectures. More than 50 % of the students decided 2003 for this teaching content, which consisted of eight theory-lecturing hours for an introduction, and a practical development work of a C2C system in teams with two students each. For this assessment project a total workload of 60 hours was scheduled.

The teams could select from a defined list of C2C information systems: E-Mail access, railway departure information, traffic channel on highways, public transportation information, situation in skiing arenas in the Alps, and remote chess playing with a powerful computer. The very useful C2C tool on traffic information is described in more technical detail in (Weghorn, 2004-2).

Meanwhile approx. thirty C2C systems were developed, for cost reasons and for providing defined conditions most of these with plain simulation of the terminal device. But around ten projects were also tested on true devices – GSM mobile phones – and it was shown that the concept was applicable. Of course, since these small projects were intended as training a first implementation, not all the defined and desired features were obtained in each system, but in sum over all these projects, all the before claimed advantageous features could be achieved.

One server machine has been reserved for these C2C systems to make these services permanently available on the WEB. A special server was set up also to achieve a short WEB access path name from the wireless terminal, and to prevent any interference with the regular IT infrastructure of our University. Currently, it is being discussed, whether there is interest among the students for investigations of the usability of the C2C systems. In this case, we can expect results of this future research by next year.

# 4 CRITICAL ASPECTS

The C2C relay is very important for achieving all the targeted benefits out of the proposed system. An average customer – in contradiction to a student at a University with IT scope – will have the problem, where and how to operate this service. Nevertheless, technically skilled persons can use WEB providers, who include server mechanisms in addition to the plain presentation of WEB contents and e-mail services, which are already widely available since several years.

Another barrier will be the installation of the terminal software on the mobile device, which again requires technical knowledge and partially even special equipment.

The system could be simplified for the end customer by using WAP or direct WEB / Internet accesses from the terminal software. This would grow the terminal software without making it less comfortable. The benefit of overcoming the intermediate C2C relay would consequence a higher price for the data transfer costs. At the moment, the

best trade off on this all is determined by the technical knowledge of the customer.

In our projects it is also like that each information system is coded individually. This was required for lecturing and training purposes, but it is not a feasible approach for professional systems. A generic framework for constructing C2C systems would be desirable, but this would require additional elaborated concepts.

# 5 CONCLUSIONS

As described, the C2C concept can offer the user of information systems on mobile terminals several important benefits: A simplified handling, a faster access speed, and a reduction of costs for information. The approach was specifically developed with the aim to small, physically very limited terminal devices, like digital hand held phones. Furthermore, it is mainly intended for personal or business information retrieval like traffic channels or departure information on railway trains.

As seen from the many implementations, which were conducted so far in our University, the development effort for such C2C systems is relatively high, because currently there is no generic approach available. Hence, the scope of future work on C2C can be – after evaluating the acceptance level of this idea from the end customers' point of view – to develop generator systems for such C2C information tools. Another research direction may be to use beside the WEB mining the described alternatives provided by public radio and TV for improving the overall QoI of the C2C information systems.

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