

# Context-Aware Telephony over WAP

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**Abstract.** In this paper we introduce a novel approach to share context to enhance the social quality of remote mobile communication. We provide an analysis of how people start a conversation in situations where they meet physically, especially looking on the influence of the situation. Than this is compared to the way remote communication is initiated using mobile phones. The lack of knowledge about the situation on the other end leads to initiation of calls that are not appropriate in the situation. The solution we propose is to exchange context information before initiating the call. We implemented this concept using the Wireless Application Protocol (WAP). The WML-based Application Context-Call offers a phone interface that provides information about the receiver when setting up a call. The caller can than decide based on that information to place the call, to leave a message or to cancel the call. Privacy issues that arise from this technology are discussed, too.

*Keywords: Context awareness, communication setup, mobile telephony, social communication, wireless application protocol (WAP)*

## 1. Introduction

Mobile phones became a ubiquitous companion to many people over recent years. The way people use phones, especially what way of usage is regarded socially acceptable, evolves over time and differs according to the group of users, types of people, and also to the country. One common understanding that is shared over most of the users is that the one who uses the mobile phone is responsible to set the phone in a mode that is appropriate for the situation he or she is in. In most cases this is a binary decision – switch the phone off or leave it on! This puts the trade-off:

- *When switching off the phone:*  
the user may miss an very important call, but he will certainly not be disturbed
- *When leaving on the phone:*  
the user will certainly not miss a call, but there may be calls that are not appreciated in the situation

When switching off the phone there is also the option to use the voice message system; but this changes the communication paradigm from

synchronous communication to asynchronous communication. It also put the burden to the user to check regularly for messages.

In this paper we investigated how to enrich the set-up of phone communication by sharing context information. Our motivation is based on observations of how people start a face-to-face conversation, and what rules they follow according to their situation. We than compare this to the way remote communication is set up with current phone technology. Furthermore we present an application context-call implemented using WAP that facilitates a richer and context-aware way for setting up remote mobile communication.

## 2. Communication in Context

Starting a conversation when meeting people face-to-face is completely different from setting up a remote communication with current technology. To motivate the context-call application that narrows the gap we first provide a brief comparison between communication in a

social environment and technically enabled remote communication.

## 2.1. Communication in a social environment

When observing how communication is established in a social setting we can see the important fact: **situation matters!** In general we see that the context and situation of both possible communication partners are taken into account when the decision is made to start a conversation or not [1]. These rules are a part of our social knowledge and children learn them very early; so the process of deciding to communicate in a certain situation to someone else is based on an implicit analysis of the mutual situations.

The person who is making the decision to approach a possible communication partner or not takes the following facts into account (this will most likely happen implicitly):

- How important is it for me to communicate now?
- How convenient seems it for the communication partner to be interrupted?
- What is the relation between the communication partners?
- What type of conversation will it be (important to whom, how long will it take, etc.)?
- Is it socially acceptable to start a conversation on a certain topic in this situation?

## 2.2. Technical Remote Communication

The initiation of a remote communication differs significantly from face-to-face communication; in remote communication the caller faces usually a situation where he or she has to make an assumption about the context of the person he or she is going to call (he is at work, she is probably back from the meeting, etc.). Then when the call is made, often at the beginning of the conversation, a question about the situation is posed, e.g.: *Where are you? What are you doing?* or *Are you able to speak?* In this way the knowledge of the situation is shared and this influences the following communication. Exchanging context information at this point is

often to late because the receiver is already interrupted. Examples of typical replies are *It is not really important, I call you later* or *If I knew that you are in a meeting I would not have called.* Considering modern phones (mobile phones, ISDN, etc.) the called party gets at least the information who is calling and can then decide whether to answer the call or not. When the caller is known by the called party, he can control whether to answer or not according his own context but without knowing how important the caller's message is.

Some mobile phones offer caller groups, enabling to comprise certain names and numbers of the phone book as groups e.g. all, family, VIP, friends, colleagues, others, see [2] for an example. By setting specific caller groups in certain profile the called party can prioritize (allow or prohibit) incoming calls according to the predefined contexts. However, the problem is still the same: “no knowledge of the situation of the called party, and no knowledge of the importance of the message of the caller”. This concept also carries a major problem – e.g. a call from a person in the family made from unknown number (e.g. in a hospital) would be blocked because the phone is set to a mode where only calls from family members are allowed.

Considering line-telephony the caller knows at least in which location the called party is (e.g. home number, work number) and can then make an assumption of the situation. In mobile telephony the caller faces a more different task – the called party could be anywhere and this makes it very difficult to guess the context of the person he or she is going to call.

There are examples where remote communication using computers offers information about the possible communication partner. One widely used system is ICQ [3]. ICQ is an Internet tool that informs users who is on-line at the same time and allows them to setup a communication channel. A further example on how to increase social awareness on the WWW is described in [4]. The project GarblePhone researches ways that allow sharing moment-to-moment level of activity between people using an audio communication system [5].

### 3. Context-Call - a WAP-based prototype

Sharing the current context of a mobile phone user appears as a possible way to enable remote mobile communication that is closer to face-to-face communication. In the prototype described in this section we provide means for a mobile phone user to give selectively information about the current context to possible communication partners. Based on this information the caller can decide - now knowing his own context implicitly and also having information about the other end - whether it is a good opportunity to place a call or not.

#### 3.1 Motivation - a Scenario

To motivate the idea of context-call we present the following scenario, composed of three situations where someone wants to call someone else.

A) Mike, a colleague of Mary, is at a customer site. He is calling Mary who is at work. He wants to ask her if she is joining him for a drink later. He calls her mobile phone number using *context-call*, now he gets back the message “I am in a meeting, please do not disturb!” together with the choice to place the call anyway, to leave a message, or to cancel the call. He decides that the question is not that important and he leaves a message.

B) Harry, another colleague of Mary, recognizes that she took the slides with the wrong figures to the meeting. He immediately calls her using *context-call*, he also gets the message “I am in a meeting, please do not disturb!” and the choices. He selects “place the call anyway” and gets her on the phone.

C) Sometime later a customer care person from her bank calls Mary using *context-call*, she also gets the message “I am in a meeting, please do not disturb!” and the choices. She realizes that this probably not a good time to talk to Mary about the new investment fond, so she cancels the call.

Using a standard phone Mary would have had the choice to switch the phone on or off. In any case she would either have missed a very important call or she would have been annoyed by two calls that were inappropriate in her current situation.

It can be seen from the scenario that the information about the context is helpful for both



Figure 1: Select a Context.

sides. Sharing contextual information gives people the chance to apply the rules of face-to-face communication also when calling over a phone. By providing the context to the caller there is an implicit negotiation, where the caller balances his own need to establish the communication against how receptive the other person is.

#### 3.2. Architecture and Implementation

The system consists of three key components: the context-call application, context-selector application, and a common database.

Each of the applications is realized using WAP and consists of front-end part based on WML and WMLScript and a backend part. The backend part is built as a CGI-Script on Apache Web-Server using the scripting language PERL. Both applications share over the backend the same database where the context information is stored.

##### 3.2.1. Context-Selector Application

The context selector application is a WAP-application where the user of a mobile phone can set the information that is given to a caller. The user has the choice of a number of pre-defined text strings, such as *Free*, *Meeting*, *Working*, *at Home*, or *BUSY*, see figure 1. There is also an option to enter free text, if the user prefers to give more specific information. The concept is similar to the profile settings used in most NOKIA phone; for a wider use this function could be integrated in the profile selection process and would than not need any additional attention from the user, another option to automate context recognition and context selection is suggested in [6].

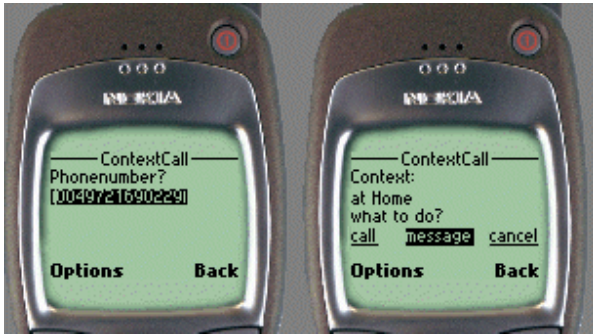


Figure 2: Using Context-Call.

When the user submits his or her context this is sent using a WAP-request to the WAP server and then handed on to the application on the server. Here a record of the phone number and the current context is put into the database. If an old record for this phone number exists this is deleted.

### 3.2.2. Context-Call Application

The context-call application replaces the normal interface for making phone calls; it is a phone interface based on WAP. The user opens the application and he or she is asked to provide the phone number or name of the person he or she wants to call, see figure 2. When the call identifier is submitted to the server a script on the server checks for the record containing the identifier (either directly with the phone number or using a dictionary to look up the phone number for a given name). If a context is recorded for the identifier that the user wants to call he or she gets the information with the current context (e.g. figure 2, *at Home*). If no context is available he gets the information that there is currently no context available. Additionally a menu with the following options: *to proceed the call*, *to leave a message* or *to cancel the call* is sent to the user.

The user has now the choice - knowing the context of the communication partner - to establish a connection, to leave a message, or to cancel the call. If the user selects message or cancel no phone call is established and the person to be called is not bothered at all.

### 3.3. On Privacy

Privacy seems to many people a concern when talking of context. Some observations at the beginning:

1. Users often share their context when they are called, e.g. "sorry I am in a meeting, could you call me later?"

2. People want to be in control of what is visible for others about them.
3. People want to know what others know about them
4. People like to share information selectively

In our first prototypical implementation we provide full control for the user about what will be displayed to other people. The user himself/herself can choose what text will appear on the callers display, and so the user is able to provide enough information for the caller to know about the context without giving away important information.

If the caller decides, "cancel" after seeing the context this is not visible to the potential receiver of the call. You could now imagine that someone checks every few minutes (or even writes a program that does this) your context and uses this information to monitor your behavior. In principle it is impossible to prevent this, because this information is needed for the caller who uses the context-call as anticipated. In our system we offer users to have a look at the statistics of their context-requests; if someone is suspicious the user is free to deny context information to this caller.

Point 4 is not yet implemented, but the system is prepared to handle this case in the following way: the user of the context-selector application can select a context description that is specific and only given to people in a buddy-list, for all other callers a generalized description is provided. E.g. the user selects the context description "in a meeting"; this description is given to people on his/her buddy list, whereas to an unknown caller the message "please don't disturb" is shown.

## 4. Conclusion

Context and the situation people are in play an important role when establishing communication. Comparing remote mobile communication and natural communication in a social environment we can observe that the social communication is much richer – and one important reason for this is the knowledge of the mutual context.

In this paper we describe the system *context-call*; it enables users of WAP-enabled mobile phones to share context and enables thereof a more selective way of setting up a remote communication. The user – who is potentially a receiver of a call, can provide information about his or her context to people who will call them. The caller can then

decide on knowledge of both sides if it is a good time to call now or not. Using this application can make the mobile phones less disturbing in many everyday situations with the benefit of being available any time.

In our future work we see space for enhancement in the user interface, especially the integration of context-selection part into the profile setting mechanism that is already build-in the phones seems important. Also an integration of the call application with the address book of the phone is important.

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