

A WE-CENTRIC SERVICE FOR MOBILE POLICE OFFICERS TO SUPPORT COMMUNICATION IN AD-HOC GROUPS

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Abstract: We-centric services are meant to stimulate and facilitate people to communicate and cooperate with others in dynamic or ad-hoc groups. Typically, a we-centric service provides hints and reasons to contact others, and, because these other people receive similar hints and reasons, stimulates and facilitates people to experience “we”. The paper describes the development and evaluation of one we-centric service prototype for police officers. We found that key-issues related to developing we-centric services are (1) finding the proper context elements and information sources to take into account when searching for relevant others, (2) presenting the people found and the context of those people in an appropriate way, i.e. with clear explanations and information on their current availability and (3) supporting reciprocal relationships.

1 INTRODUCTION

People are social beings. We belong to different groups, such as family, friends, colleagues, clubs or interest groups. We want to – or have to – combine or balance roles and tasks in order to maintain memberships to these different groups. E.g. people combine private and work roles, or balance different tasks with different people within one job. Furthermore, many groups are dynamic or formed spontaneously, i.e. its members may not be known beforehand and may move in and out all the time, based on changing context. This has led to a domain of (mobile) social software, or “MoSoSo”, software on smart mobile devices that facilitates social encounters (Kjeldskov and Paay, 2005), (Kowitz et al., 2005), (Rheingold, 2003) and supporting architectures designed to help people communicate with small groups of people such as close friends,

colleagues or relatives (van Eijk et al., 2006), (Nars, 2004).

Currently, Instant Messaging applications such as MSN Messenger are available on mobile devices, e.g. Smartphones. Thus, these types of mobile applications are in theory capable of supporting dynamic or spontaneous groups. However, they support one relatively stable group of people that is manually created and managed by one user. Sessions are also manually initiated by one user, based on that specific user’s interpretation of availability of others. Thus, this type of applications ignore the fact that people do not know beforehand with whom they could or should communicate.

Secondly, in this type of instant messaging applications, sharing of context between (mobile) users is limited to presenting availability, clues about mood or activity or recent pictures to the other. Again, it is one user that controls how and when she shares context with others. However, following the definition given by Dey (2001) we

should consider that context is *any* information that can be used to characterize the situation of an entity, e.g. an individual or a group. Sharing of all kinds of context information with others is crucial in the design of mobile group applications since it helps people to find efficient or effective ways to communicate (van Eijk et al., 2006), (Erickson and Kellogg, 2000), (de Poot et al., 2004), (Schmidt et al., 2004).

The limitations of the applications given above follow from the fact that they are designed according to the I-centric paradigm. I-centric services are associated with an individual who controls the environment, including other people (Arbanowski, 2004). It strongly emphasises the “user in control” concept and it ignores the fact that relations between people are potentially reciprocal. Therefore, we propose to use a we-centric paradigm to design mobile social software, where this reciprocity is an essential property as we will illustrate here.

2 WE-CENTRIC SERVICES

We-Centric services are the counterpart of I-centric services. We envision we-centric services that help people to communicate and cooperate with others in different, dynamic or spontaneous groups, and to combine and balance tasks and roles effectively, efficiently and pleasantly (see Figure 1). We-centric services are by definition context aware. Context is used for determining which users are part of a social context (the “we”) and context can then be shared between those users.

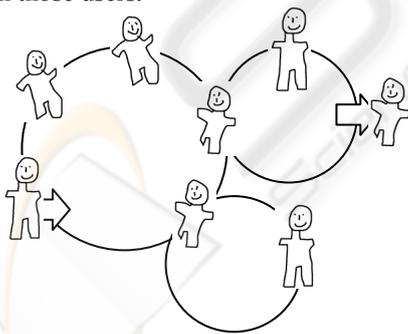


Figure 1: We-Centric services help people to communicate and cooperate in different, dynamic or ad-hoc groups.

We propose that a we-centric service automatically composes and provides a dynamic list of people that may be “useful” to you – “useful” in the sense that these people are possibly relevant and available. Additionally, it may hint that you may want to contact them.

The three following research questions are relevant.

How can a we-centric service define the set of people (“we”) that is indeed relevant in the current context?

We assume that one must find, for a certain application domain, some proper and useful context elements or information sources for this goal. Typical examples are availability, location and working rosters of people. The question then remains what type of context elements are needed for a specific domain or scenario, how to find and select them together with end-users and if there are many, how to convey, aggregate, combine and/or interpret them.

How to represent these people in a way that end-users get a shared experience of “we” and indeed use the information to start communicating and collaborating?

The supposed added value of we-centric services is that they support people to form dynamic or spontaneous groups and communicate and cooperate with people they would otherwise not or less easily communicate or cooperate with. Furthermore, the service must enable the end-user to combine and balance group memberships and tasks that may interfere or even conflict.

How to develop a we-centric service together with end-users?

We-centric services are about people and they are typically domain-specific and they must take into account working practice and social relations between people.

This paper describes how user requirements were captured, the development of one we-centric service together with end-users, and an evaluation of the added value of this service. The intended contribution of this paper is to position we-centric services as a new kind of (mobile) social software for (semi)professional users, and to explain the development of one application, including a software algorithm and user interface, together with end-users.

3 FIELDWORK WITH POLICE END-USERS

In order to develop the we-centric service we interacted throughout the project with the intended end-users: Police Officers who work in the field. Introducing applications into the work of mobile police officers is especially challenging and when developing such services it is essential to follow a user-centred design. If not, things like the user interface, e.g. the way information is represented on the screen, may end-up with serious design flaws, making the result unacceptable and unworkable in practice (Marcus and Gasperini, 2006).

In order to learn about police work, seven project team members spent a day with police officers – a method known as “rapid ethnography”. We learned that two types of police officers work in the field. Emergency Police Officers respond to incidents and work in larger areas. Community Police Officers are assigned to one specific neighbourhood and work more according to tasks and plans. We observed that the work of Emergency Police Officers is driven by incidents: they often do not know what will happen next and improvise a lot. They cooperate with other police officers and with external network partners: e.g. people from the municipality, shop owners or school directors. Police officers often need implicit knowledge of others: knowledge in the heads of other people, and usually not available in databases, e.g. a person’s personality, a person’s social relations, or the location of certain keys. When Emergency Police Officer Nick goes to an emergency it would be good if he knew what Community Police Officer William, who was there last week, knows: namely that when this man X becomes angry, you should rather ask his neighbour Y, and not his neighbour Z, to calm him down.

A workshop was organized with the police officers observed earlier, in order to validate our observations and to present them our first ideas for a we-centric service. Based on the results of that workshop we chose to focus upon improving communication and cooperation between Emergency and Community Police Officers. This focus was also justified by the author of a large ethnographic study of police work (Stol, 2004), who saw that the two types of police officers cooperate relatively little with each other. He suggests that the overall quality of police work would improve when other officers could use the implicit knowledge of Community Police Officers who work for many years in one area and have an intimate knowledge about this area.

Based on our observations and the workshop results sketches were made for a we-centric service, that we named “WijkWijzer” (in Dutch). This name is a wordplay, where “Wijk” means “Neighbourhood” and “Wijzer” can mean both “Pointer” as well as “Wiser”. The name thus refers to its function: it points you to other people who may help you (or you may help them) by exchanging implicit knowledge, making both parties wiser.

In order to evaluate these ideas several workshops were organized with both Community and Emergency Police Officers. A method similar to Place Storming (Andersen and McGonical, 2004) was applied to assess the added value in enacted work situations. The police officers were asked to play three situations, first without and then with the WijkWijzer.

In the workshops we first learned that the users find it important to know *why* a person is relevant when it shows up on the screen. This is a bit similar to the users’ opinion found by Iachello et al. (2005). They found that the users want to know why somebody is indicating an interest in their location. Then we heard that it is likely that Emergency Police Officers – who must react quickly to urgent reports or emergencies – will not always contact Community Police Officers beforehand to obtain information. It seems more likely that Community Police Officers proactively offer their knowledge to Emergency Police Officers. We also learned that Emergency Police Officers have knowledge that may be relevant for Community Police Officers, namely knowledge about what happens during the evenings and nights, and over larger areas. So the WijkWijzer should enable reciprocal communication: either of the two people involved (“we”) can start the communication.

4 WE-CENTRIC APPLICATION FOR POLICE OFFICERS

Based on all the interactions with police officers, the ambition was formulated to develop and evaluate the WijkWijzer: a mobile application to support police officers to identify other officers with whom they can communicate in order to exchange implicit knowledge about the incidents they are currently working on. This idea was strongly based on our obtained knowledge on police processes and our ambition to improve spontaneous communication.

4.1 Application Functionalities

A prototype application was made consisting of a client for a PDA and a server. The server hosts an algorithm that finds relevant officers for a specific incident (see next subsection). In short, the prototype does the following.

1. When an incident is reported, a report is generated and assigned to one police officer (A);
2. The police's database is searched for police officers that may have relevant implicit knowledge about this incident, and for each police officer found, a "utility" is calculated based on relevancy and availability – this function is explained in the next section;
3. The report is sent to the police officer who was assigned to that incident (A), with a list of supposedly "useful" police officers (B), their contact details, availability, a reason to contact them, and an indication of their "utility";
4. The name, contact details and availability of the police officer whom was assigned to that incident (A) is sent to all the supposedly "useful" officers (B), with the reason why they may be contacted, and an indication of their own "utility".



Figure 2: User interface of WijkWijzer.

A user interface was developed for a mobile device that police officers are currently using (see Figure 2). When an incident is assigned to a police officer (A), he receives a message that there are other police officers (B) that may be relevant and available for him. The user can easily see reasons and utility scores and contact details. Additionally, B receives a very similar notification so B can pro-actively contact A.

4.2 Algorithm for Finding People

Our goal here was to define an algorithm, which identifies one or more relevant police officers that may be relevant for a specific incident. Based on an analysis of current working processes and information sources used by police officers, we designed a data model that links specific incidents to relevant police officers, via several different paths.

The following information from the police processes and database is used in this data model and algorithm:

- Every "incident" is reported as a "mutation", and each "mutation" is authored by a specific police "officer" and is associated with a (geographical) "location";
- Police officers sometimes make additional notes to pay attention to a certain location or person: "appointment on location" or "AoL", or "appointment on person" or "AoP";
- Emergency Police Officers work according to "rosters" and are assigned to certain "neighbourhoods" via these rosters. "Locations" can be mapped into these neighbourhoods;
- For the purpose of our research and prototyping we assume that the addresses of "suspects" (people who appear as "AoP") are stored in an address book.

We identified five meaningful paths through this data model that go from a specific incident to a specific police officer:

- Mut: The incident is related to an earlier, previous mutation, which was authored by a specific police officer
- AoL: The location associated with the incident appears as an "appointment on location" (AoL), which was authored by a specific police officer
- AoP: The name of a person or suspect in the mutation appears as an "appointment on person" (AoP), authored by a specific police officer.
- AoP: The location associated with the incident is linked via an address book to the name of a suspect who appears within an "appointment on person" (AoP), authored by a specific police officer.
- Area: The location associated with the incident lies within the neighbourhood

where, according to the roster, a specific police officer is currently working.

These five paths are the basis for an algorithm that identifies one or more police officers that are relevant for a specific incident. For paths 1, 2 and 3, the “age” of the mutation, AoL or AoP are also important: older entries are likely to be less relevant than newer entries.

Since police officers often work in emergencies (especially Emergency Police Officers) it is important that colleagues are not only relevant but also available for communication or cooperation. Preferably the WijkWijzer should enable instant communication. The availability of an officer depends on:

- Service: The number of service hours left for that day of a specific police officer – which can be found in the roster;
- Status: The current availability which the end-users sets herself on her terminal: off-line, busy, available.

From all variables, we derived an equation that calculates the “utility” of a police officer as a function of her relevance and her availability:

$$Utility [between 0 and 1] = f(AoL, AoP, Mut, Area) + f(Service, Status),$$

where AoL, AoP, Mut, Area, Service, Status are between 0 and 1.

Using this equation, the algorithm can rank officers by calculating their respective ‘utilities’.

5 SMALL-SCALE TEST

All server functionality was implemented on a web server that was coupled to a database containing all fields relevant for the algorithm. The client was originally developed for a consumer PDA with communication capabilities (QTEK 9090), but for the test we decided to use the same client on a robust heavy-duty PDA (Panasonic CF-P1). The WijkWijzer application was tested in a small-scale test in which five police officers used the prototype for a few days on the street during their work. In this test one observer sat in the emergency room and fed the WijkWijzer server with information on rosters, appointments made in the past (AoL and AoP), mapping of locations to neighbourhoods and officers assigned to that areas. Then, during the test, the algorithm was additionally fed with information on

real incidents. So, for each incident, all relevant utilities were calculated on-the-fly and dependent on the results, messages were sent to the proper police officers in the field. Three other observers joined officers in their car. We observed experience (how did the end-users react to the information presented on their device?), added-value (how useful is the application for their work?), functionality (does the algorithm produce the proper results?) and usability (was the information presented in a usable way?).

The results were as following. Concerning experience we observed that the police officers enjoyed taking part of the test and were very curious about what was appearing on their devices. Due to some technical problems, there was a delay or loss of some incidents, which lead to some distrust of the system. Concerning added-value we observed that the application was not useful in routine cases like car accidents. It was quit useful in those cases were Emergency Police Officers had to operate in a neighbourhood or area that was unfamiliar to them or that was not their home area. In those cases Emergency Police Officers for example do not know who are the assigned Community Police Officers. Especially in those cases people may be suggested that are unknown or unfamiliar to them and they normally would not communicate with.

The application was also useful in cases were social issues or cases with longer histories are relevant, like family relation issues. Our assumption that our application has to be reciprocal was confirmed; we observed cases were Emergency Police Officers had knowledge for community Police Officers and vice versa. Concerning the functionality, i.e. the algorithm, our observations seemed to indicate that the algorithm delivers the right names. Showing the name of the correct Community Police Officer that is assigned to a location was found the most useful. What was missing were names of people that have been at some location, which are not necessarily the Community Police Officers of that area. Location seemed to be another relevant context parameter, since it strongly influences the decision to communicate or to travel to and co-assist the other.

6 CONCLUSIONS

Because the evaluation of our application was on a small-scale we need to be careful with our conclusions. Furthermore, we realise that conclusions on added-value of our ideas are only valid in this domain. Yet, based on our experience in

developing and testing this we-centric service for police we can draw some preliminary conclusions and give some preliminary answers to our research questions.

With respect to the question of how to define a set of relevant people we learned that developers of we-centric services should find out what information people want to have, what knowledge they share in the field and what their incentive is to communicate. It is also important to study which context elements are relevant, for example whether it is relevant to use positioning technology or not.

All information sources used to find people relevant for the current context must have at least two characteristics. First, they must link to the current *situation*, in our case, everything was connected to the current incident. Second, they must have a link to specific *people* that can help and be contacted, for example, in our case, a specific *person* edited every source of information used. Note that we always assume that the person that can be contacted knows more than what is available in the information system, for example he or she has implicit knowledge about a case, a person or a location. The situational context elements chosen here were about the availability of the officers and the location of current as well as past incidents. Additionally, we found that a we-centric service may have added value, when unknown people are suggested, rather than people one would contact anyway. One must realize that suggesting unknown people to each other opens a can of trust and privacy issues (van Eijk and Steen, 2005).

With respect to the question on how to represent the set of people and induce a “we” experience and stimulate communication, we found in general that, since we-centric is people centric, providing information alone is not sufficient. First, end-users would want to know *why* a person is relevant. This means that a we-centric service should provide reasons why the system suggests that people are relevant in the current context. Second, suggestions are *reciprocal*: when A receives a suggestion to contact B, B should always receive a notification so B can pro-actively contact A. Third, any suggestion must include the name of a human person. We even decided to use pictures to improve the sense that information is coupled to a person. Finally, in order to stimulate communication it is important to show people’s availability and the ways one can contact the other.

From developing a we-centric service together with end-users, in our case police officers, we learned the following. It is important to find out the

communication patterns, working practices, culture and social relations between all types of end-users. Developers should be aware that their solutions may change the organization structure, for example WijkWijzer may change the role of the emergency room. In general one can say that we-centric applications are more suited to ad-hoc collaboration scenarios, rather than to scenarios where central steering is practice.

The authors are aware that the test was small-scale and a longer evaluation of the application with end-users is necessary to draw more solid conclusions. One might argue that the motivation triggered by the gadget factor affected the users’ views and their willingness to participate. On the other hand, we found that police officers are very critical with respect to the introduction of new devices that they have to carry around and operate. This means that as soon as they find it useless or hampering their work they will quickly stop using it, no matter what gadget it may be. Their willingness to operate is thus probably more due to the fact that they appreciate attention from a research group that is not related to their management.

It was not our goal to develop, introduce and enrol a working system. Before this application can be enrolled and scaled up, more study is needed on the type of situations where the application may provide useful tips, more study on the time gain versus cost, providing a better user interface, more stability, better security and last but not least, more support from national police management.

Summarising we found that key-issues related to developing we-centric services are (1) finding the proper context elements and information sources to take into account when searching for relevant others, (2) presenting the people found and the context of those people in an appropriate way, i.e. with clear explanations and information on their current availability and (3) supporting reciprocal relationships.

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