

Issues in the Development of a Mobile based Communication Platform for the Swedish Police Force and Appointed Security Guards

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ABSTRACT

This paper presents the learning experiences from the development of a mobile-based communication platform, called OrdningsVaktsCentralen (OVC). OVC can be translated to Security Guard Central. OVC is designed to enable the Swedish Police Force (SPF) to comply with new legal requirements and enhance their collaboration with Appointed Security Guards (ASG). The focus of this paper is on the early phases of development; in particular on the specific technical issues such as interoperability and standards used in the development of mobile based systems. The learning experiences are as follows: firstly, when developing mobile based systems we suggest and recommend that the analysis phase should be enhanced and it should address the interoperability between mobile phones on one hand and operators on the other hand. Secondly, global and national standards, such as the MMS7 for sending multi-media messages, are not always standardized. It seems that operators and mobile phone manufacturers make minor alterations and interpretations of the standard and thereby some of the benefits found in standards disappear. Thirdly, mobile based communication platforms have a large potential for contributing to the field of emergency management information systems since they can be based on open and nationally accepted standards.

Keywords

Emergency management information system, mobile-based, communication platform, interoperability, information systems development.

INTRODUCTION

This paper presents the learning experiences from the development of a mobile-based communication platform, called OrdningsVaktsCentralen (OVC). The OVC (Security Guard Control system) was designed to support the administrative task of monitoring (keeping track of when a security guard is on duty) Appointed Security Guards (ASG). Since the beginning of 2005 this task has been a mandatory task for the Swedish Police Force (SPF). The focus of this paper is on the early phases of the development of the a mobile based communication platform. Two major issues occurred during the platform development. The first is the lack of interoperability between different operators and different phones. The other issue is related to one of the more widespread mobile phone standards, MMS7.

The contribution of this paper is related to the development of an Emergency Management Information System (EMIS) (Landgren 2005, Wood 2005), which is a growing field within the information systems community. It also contributes to the development of mobile based information systems, which is a growing and increasingly important technical platform for EMIS.

The paper is organized as follows: the next section addresses the research approach. This is in turn followed by the case presentation which includes background, development, problems, and solutions. The final section presents the main learning experiences from the platform development.

RESEARCH APPROACH

This is a case study (Yin 2003) in which the object of this study is the development of a mobile based communication platform. The focus is on the technical issues related to the development of the system and the

unique features that are involved in developing mobile based systems. The study will be mainly done from the perspective of the developing firm. The research question was centered upon interoperability and the role of standards during the platform development and how they were managed and affected this development.

The main method used was interviewing and analyzing internal documents. In relation to the development, we asked respondents from the SPF and the developing firm how they perceived the development, what the issues (mostly of technical nature) of the development were, the pros and cons, and the way they managed the development. We conducted a total of nine interviews, of which five were with representatives of the developing firm, three from SPF, and the final interviewee was an ASG. The interviews were semi-structured, including some closed questions and some open questions to ensure exploration. Two researchers shared the interviewing process which lasted on average between 60 and 120 minutes. The interviewees were selected specifically in order to provide a broad representation of those involved in the development project.

We used a grounded method, where we let the empirical observations be the basis for writing the case. Thus, the case description is not influenced by existing theories. In accordance with the grounded approach, the structure of the presentation of the empirical findings below is based on observations instead of being based on pre-existing theory.

THE DEVELOPMENT OF OVC

In this section we describe the context, the background, and the process of developing the OVC.

Context and background

Appointed Security Guards in Sweden have a specific job where the ASGs have limited police authority while they are on duty. It is important to be aware that an ASG has this limited police authority only while on duty. Otherwise, an ASG has the same rights as a private citizen. ASGs are often employees of a security company and work at their company's client's facilities either on a regular basis or at a specific event such as a concert or other public event. On an average evening about 2 500 ASGs and 600 policemen are on duty in Sweden. Thus, ASGs constitute a large and important part of the legal force that maintains law and order in Sweden. The main tasks and work areas for ASGs are to maintain law and order at specific locations, such as concerts, soccer games, or restaurants, and to protect private property. The ASG's work assignments are in part stipulated by Swedish authorities. If anyone arranges a large event they must hire ASGs or consequently they will not receive permission to organize the event.

Present situation

The as-is workflow is as follows; when an ASG starts their work shift he or she reports, or should report, to the local police force (LPF) with a fax message including the time, the surveillance location, and their ASG identification number. An important restriction is that the report must be sent precisely when their shift begins; the ASG is not allowed to announce their duty in advance. The same protocol must be heeded to report the end of the ASG's shift: name, place and id-number sent to the LPF via fax exactly when their shift ends. These requirements were enforced by law on January 1st, 2005. The main purpose of this law is to ensure that the ASGs could be contacted if a situation arose that required enforcement by an ASG. Another purpose was to ensure that an organizer of an event really had enough of ASGs as stipulated by the event permission from the local authority.

Problems with current situation

This way of reporting duty through fax messages results in several problems both for the ASG and the LPF. The ASGs find it a bit awkward to send a fax every time their shift begins or ends, so awkward in fact, that they often neglect to send in the fax as many of them travel directly from their home to their workplace and do not always have access to a fax machine. On the other hand the LPF do not have the resources to follow up on who sends in the reports and who does not. If all of the ASGs would send in all their reports, it would be an amount of at least 30 000 faxes per week. The SPF conducts some random spot checks to ensure that the ASGs send in their reports, but this follow up is not harsh enough to make the ASGs send in their reports. In addition, if the ASGs would send in the fax reports, the LPF would not have the resources to administer all the faxes. Furthermore, a fax based reporting system does not enable any collaboration between the SPF and the ASGs. An additional problem is that the SPF does not know which ASG is on duty or where. In sum, we have an in-efficient and un-effective system, which calls for an innovation.

Proposed solution

The following scenarios depict the way the LPF want to be able to use the ASGs while they are on duty:

- Regular duty, who, where, and when is of interest.
- Assume that an elderly person suffering dementia is missing. If there is an ASG in the area who can get a description of the missing person from the LPF the ASG can keep watch for the missing person.
- Hooligans, at a soccer game, are raising a riot and the LPF needs backup fast. ASGs on duty in the neighbourhood are the closest and fastest available resource and could make a difference if they were at the scene early.

Based on these and other scenarios an initial solution was presented (Figure 1). The proposed solution was a web-based communication platform that mediates communication from a web interface to a mobile phone and vice versa. ASGs were equipped with mobile phones with SMS (Short Message Service or text message in the USA) and MMS (Multi media service) capability.

Example of proposed workflow

1. When the duty begins the ASG sends an SMS to a specific number. The message contains information about where, whom, and what (begin or end of duty). For example, the information can be sent in following format: **L23, ASG44, B** ([Location], [ASG id-number], [Status; B=Begins]).
2. When the SMS is received by the OVC-server the actual date, time, and the phone number of the mobile phone that the ASG used to send the SMS with is registered along with the other information contained in the SMS.
3. The LPF can log on to the web server and easily read on the screen which ASGs are on duty and where they are on duty.
4. If an incident occurs, the LPF can create an SMS or MMS via the web interface, choose a recipient from a list of ASGs on duty, and send the message directly to the chosen ASG.
5. The ASG can respond on a received message to the OVC-server. The ASG can send in reports to the LPF via the OVC-server, using both SMS and MMS messaging.
6. At the end of their shift the ASG sends an SMS to a specific number. The messages contains information about where, whom, and what (begin or end of duty). For example the information can be en following format: **L23, ASG44, E** ([Location], [ASG id-number], [Status; E=Ends]).

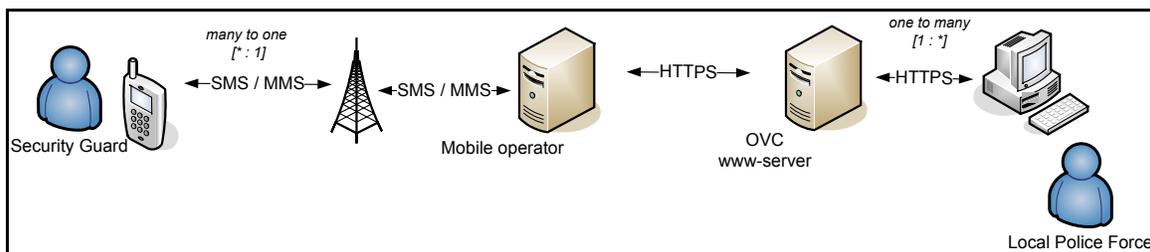


Figure 1. The proposed communication structure of the OVC-system. A police officer composes an SMS/MMS and sends it to one or several ASGs. The message is stored on the OVC-server. An ASG can send an SMS/MMS to the LPF and the message is stored on the OVC-server.

Problem solved with the proposed solution

The system support received on the earlier mentioned scenarios was as follows:

- Regular duty, who, where, and when is of interest. The information sent to the server was stored and easily accessed by the LPF, for present and future use.
- Elderly person is missing. An ASG in the area could get a description through his/her mobile phone of the missing person (and a picture of the person) by an MMS.

- Hooligans are raising a riot and the LPF need backup fast. The ASGs on duty in the neighbourhood could be alerted through a SMS and come to location and assist the LPF.

Besides these scenarios, there are several other benefits: The ASG can inform the LPF when going on duty and leaving duty from his work place and thereby does not have to go to his office. LPF and SPF gets a tool to comply with the new legal requirements and the capabilities to control ASG on both a local and national level.

The design phase

During the fall of 2004 contacts were taken between SPF and different developers. However, the process was slow in the beginning and it was not until the fall of 2005 that the legal department of the SPF and one of the LPFs decided on acquiring a system to support the collaboration between the SPF and the ASG that allowed the process to take off. The case was discussed with developers at 21st Century Mobile (an IT-consultant firm with experience from nomadic computing). As a result of these discussions, several scenarios and a proof of concept of how a mobile-based communications platform could support the collaboration between SPF and ASG were discussed.

Issues discussed but neglected

There were some discussions about security issues with the SPF. Since this was the first iteration in the RAD (Rapid Application Development) cycle the most interesting discussion was if the system would work at all. The SPF regarded that many security aspects should be addressed during the later development cycles.

Data reliability: is the data safely stored? The normal police-related data is stored in at least six different locations to ensure protection of data loss. This system would use a single server with RAID-discs to ensure some degree of data loss protection.

Unauthorized system use. The system was at this time a non-critical service so the SPF regarded this problem as minor, for the moment.

System capacity. In case of a large incident the GSM-network probably would be overloaded with ordinary voice-calls and jam the traffic (it would not be possible to connect to the mobile operator at all). This problem had no trustworthy solution and that was the most serious problem. Another perspective on a similar topic was then did the SMS/MMS traffic reach volumes so that the channel would be jammed? The system could deliver 13-53 SMS per second depending on the different circumstances which mobile operators use (the system is sending the messages in the receivers net).

If implemented to full scale the SPF Data Center would take charge of the operation of the system. That this not was regarded as strictly police business resulted in that the legal restriction did not affect this system at all. Several of the security issues were considered important, but the gain of the system was regarded to be of greater value than the possible consequences of misuse or security related problems. All this is in comparison to the present situation.

Alternative solutions as implementing applications on the phones were discussed; however the types of phones used by the ASGs were so heterogenic so it was considered impossible to use anything other than standardised communications without any programming or installing of applications.

Developing the proposed solution

The OVC-system was developed through RAD (Martin 1991, Mathiassen et al. 2001) with the goal of presenting a quick and functional solution for assessment by the SPF, LPF, and ASG. A mistake that occurred in the analysis phase was to underestimate the complexity regarding the heterogeneity between services offered by the mobile operators and the technologies regarding mobile phones. Even if this domain was supposed to be standardised it was a cumbersome work to investigate and to handle the heterogeneity.

The easiest part was to establish the outgoing functions. Sending an SMS and a simple MMS was if not easy, manageable (in respect to time, cost, and expertise). Then the more challenging work started with more complex MMS and several different types of mobile phone problems with heterogeneity or lack of interoperability between operators and media files occurred. Figure 2 summarizes the different interoperability problems faced during the development. Each major interoperability problem is illustrated below.

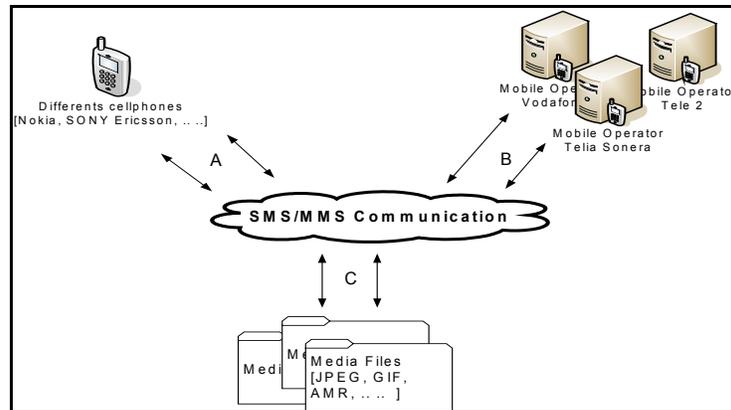


Figure 2. Problem areas regarding interoperability.

Phones

When the mobile phones received an SMS there were no problems, but when an MMS arrived to a mobile phone the results differed depending on what type of mobile phone it was. Often different mobile phones interpreted the MMS SMIL-file in different ways resulting in a range of errors. The result was that it was impossible to design a SMIL-file that could be correctly interpreted by the different mobile phones on the market. This problem occurred even among different devices from the same manufacturer.

Operators

Developing a send-component that sends an SMS/MMS from a platform like the OVC was a straightforward task, but when it came to building a receiving-component some problems arose. To be able to receive a MO (Mobile Originated) SMS/MMS the system must use an abbreviated number (for example 71234 instead of a long number as 0709-22 33 44). In fact, the SPF insisted in using an abbreviated number for the reason that it would be easier for the ASG to use an abbreviated number and to reduce problems related to interconnect between operators. These requirements complied with the fact that TeliaSoneras platform for sending and receiving SMS were not capable of using a long number. A comment worth mentioning is that TeliaSoneras platform did not follow standards like SMPP/MM7. These abbreviated numbers are operator specific. If a mobile phone used a SIM-card (i.e. subscription) from Vodafone the abbreviated number (71234) must be registered at Vodafone and a receiving-component that listened to calls from Vodafone had to be implemented. If the mobile phone used a SIM-card from operator TeliaSonera, the transmission of the message would fail because Vodafone was the “owner” of that specific abbreviated number (71234).

Media files

Different mobile phones interprets one and same media-file, e.g. JPG file, in different ways. This problem occurred even when it encountering pictures in JPEG and GIF formats which could be considered standard formats in low resolution. JPEG and a GIF can have different “hidden” features that can create problems (interlaced, exiff, compression). The result was that there was a risk that an attached picture in a MMS was never viewed.

Solving the problems

Phones

The SMIL / MIME problem was not solved completely but by using a simple form of SMIL-file the problem was minimized. This SMIL-file did not allow collections of images or more complex data-types.

Operators

To handle the problems with interconnect and the abbreviated number the system, it was necessary to sign accounts with every mobile operator in order to cover a specific abbreviated number at all mobile operators, see final solution in Figure 3. The solution became substantially more complex and expensive than the initial solution. The interface between the OVC and the operators SMS-C and MMS-C are different which resulted in high development costs and

expensive subscription fees. Another aspect was that some operators send an MMS as a SMIL-file and other operators send it in a MIME-format which is not something that can be handled at this time. A third aspect was that operators are continuously enhancing their platforms and as a result of this, the OVC senders and receivers have to be reconfigured from time to time.

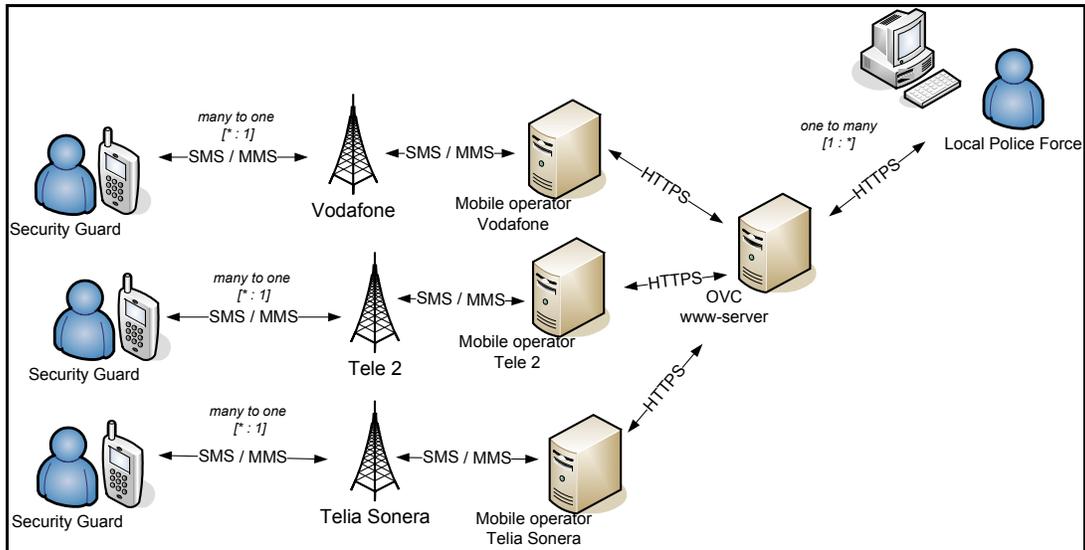


Figure 3. The communication structure of the implemented system. An SMS/MMS sent from the OVC-server is transmitted to the same mobile operator that the ASG uses. A police officer composes an SMS/MMS and sends it to one or several ASGs. The message is stored on the OVC-server. An ASG can send an SMS/MMS to the LPF and the message is stored on the OVC-server and a police officer can read the message. An ASG can also send one or several SMS/MMS to one or several ASGs. These messages are also stored on the OVC-server.

Media files

This problem was not completely solved. The media file problem was partially solved with an automatic converter installed on the server that changed the picture format to a JPEG with no “hidden” features that had a high possibility to function well.

Future work

In the next version of the system, security aspects such as the protection against data loss and intrusion are on the agenda. In respect to operation reliability the suggested solution is to have redundant OVC-servers and to use the different operators to enforce higher reliability in sending SMS/MMS. If one mobile operator’s service causes the system to crash the system should automatically change the preferred operator to another that is in service.

LEARNING EXPERIENCES

In this final section we summarize some of our learning experiences from the case and present some ideas on future research endeavours.

- Learning experience one: When developing a system including standard mobile phones such as MT (Mobile Terminated) and MO (Mobile Originated), the “workload” in the system development phases is somewhat changed. The analysis phase must be more comprehensive because of the interoperability in the mobile operators systems and the interoperability among the mobile phones. The architecture of a system like the OVC must, to as great of an extent as economically possible, be component-oriented, have high scalability, and be designed for reconfiguration in order to deal with the changing environment since mobile operators change the technical interfaces and there is a rapid development and deployment of mobile phones. As a final remark, the developer of a mobile-web system, such as the OVC, should aim at three moving targets at the same time: the operators, the mobile phones, and the media files.
- Learning experience two: Developing information systems in an emerging technical area with many stakeholders (such as phone manufacturers, mobile systems provider, operators, and media files) creates new and unforeseen

problems and issues that are difficult or impossible for a single developing firm to manage. To manage this situation there is an increasing need for standardization on both a national and on a global level. Even though standards such as MMS7 exist, each stakeholder seems to make minor changes which contribute to a world of interoperability. One can also assume and make the conclusion that this stakeholder behaviour leads to sub-optimization and a slower growth of advanced mobile-based service.

- Learning experiences three: Mobile-based communication platforms have a large potential in enhancing the field of EMIS, since they can be based on existing “open” standards, which make the rapidly increases the speed of development – even though there are still some problems.

The development and enhancement of the OVC will be a continuous process over the next few years. In our future research we will focus on two major issues. The first issue is related to interoperability and how it may be solved. For instance, through better collaboration between operators and manufacturers or through the development of a middle layer that will manage various kinds of interoperability, such as file formats. The second area is aimed at addressing the use of the OVC from both organizational and individual perspectives.

REFERENCES

1. Martin, J. (1991) *Rapid Application Development*, MacMillan. Hampshire.
2. Mathiassen, L., Munk-Madsen, A., Nielsen, P. A. & Stage, J. (2001): *Objektorienterad analys och design*. 2:nd ed., Studentlitteratur, Lund.
3. Landgren, J (2005) Shared Use of Information Technology in Emergency Response Work: Results from a Field Experiment, in *Proceedings of the 2nd International ISCRAM Conference* (Eds. B. Van de Walle and B. Carle), Brussels, Belgium, pp. 35 – 41.
4. Yin, R.K. (2003) *Case Study Research, Design and Methods*. SAGE
5. Wood, M. (2005) Cell@lert, For Government-to-Citizen Mass Communication in Emergencies; “It’s about time”, in *Proceedings of the 2nd International ISCRAM Conference* (Eds. B. Van de Walle and B. Carle), Brussels, Belgium, pp. 323 – 326.