

MOBILE WORKFORCE USING PDA, EXPERIENCES AT VATTENFALL

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ABSTRACT

During 2005 Vattenfall began an ambitious implementation of PDAs (Personal Digital Assistant) for service technicians. This paper describes the experiences made from this project, which had the goal to provide Vattenfall with a mobile digital platform. The complete software solution was shown to be too large for the PDAs, and the full scale rollout was stopped. Components of the solution still proved to be very useful for the personnel. Experiences from a parallel project with PDAs for meter exchanges, were also positive. From these projects, Vattenfall now has a better view of how IT-tools really work in the field.

BACKGROUND

Vattenfall Service is a service provider within Vattenfall in Sweden. It has a total of about 1800 employees, mainly service and operative personnel, working with electrical distribution and transmission network as well as power generation. The company is established in about 65 local offices, geographically spread throughout Sweden.

As a means of getting a common platform for job/order-administration, Vattenfall Service 2002 started to implement SAP R/3 Customer Service, chosen as the main ERP-system (Enterprise Resource Planning) within Vattenfall Group. After the system was successfully implemented by 1st Jan 2004, the natural step was to focus on the mobile functionality of the system.

Aside from order management, a demand of better general tools for maps and navigation came from the field workers. Personal alarm was also on the agenda, since some accidents had risen the demand, as well as positioning of the nearest service technician.

Also, several organizational aspects had been brought up. The last years the administration on the offices had grown but the number of service technicians being constant. To challenge this trend, the goal would be to have more self going technicians on the field, doing a part of the administration.

THE SOLUTION

The solution was brought together as a joint venture project under the coordination of IBM Sweden. Three software vendors were involved, named below:

SAP

The main CS-objects in R/3, Serviceorder and Notifications, were naturally candidates to be made 'mobile', using the add-on called MAM, Mobile Asset Management. It is a

Java-based application that is run using Internet Explorer and is fully compatible for both PC and PDA. The orders are synchronized to the PDA to become off-line, then reporting time and costs as well as technical details. The SAP backend infrastructure contains synchronization logs and reports. For the PDA-client some improvements in the user interface were made. The best benefit was the standard compatibility with the configuration in backbone R/3.

Mapinfo

For GIS and Map-support, the solution MapX Mobile from Mapinfo was chosen. Vattenfall Service had used Mapinfo for several years and had competent GIS-technicians with good experience of Mapinfo.

Pocketmobile

Pocketmobile is a vendor of a PDA-platform that includes several components based on wireless communication with PDAs, such as positioning and order management. Since they had the best knowledge of the hard- and software aspects of PDAs, Pocketmobile was the solution integrator.

PDA Hardware

The hardware must meet a long list of requirements, for example robustness, screen and long lasting battery. It was also important to get a high performance in the PDA. Several devices were tested, like Qtek and Intermec, but finally the Recon 400 from TDS was chosen for its large and clear screen, robustness, and possibility to put a GPS in a CF-card slot on the top of the PDA.

Security issues

Also the security issues like VPN were addressed. This was to be worked through by Vattenfall IT-company, based on general security instructions within Vattenfall Group.

USE CASES

Several different improvements in work performed within Vattenfall Service were anticipated, here described below:

Job planning

To make the service technician more empowered and selfgoing, the first step is the planning process. The goal is that every separate job is created as a Notification within SAP R/3. Each Notification can address to a workgroup divided into planning groups and finally a named responsible service technician. With the technician login into SAP MAM in the PDA, the notification can be synchronized to the right device.

Change of Status

The change of status is vital for a well working process. With an online/offline-solution it is useful with a signal to the work leader that the service technician has received and checked out his notification, and later on also has done the job. The last step is to finally report the job to the customer. The function of signaling to the service technician by SMS was added to the use case list.

Reporting details

Different information is interesting in different cases. Planned maintenance based on fixed pricing would be the easiest. In other cases, both time and material and chemicals must be reported. On outage events the cause as well as what was done is highly interesting for follow up reasons.

Positioning and Personal alarm

Since there in Sweden can be fairly large areas that service technicians operate in, information of the one who is nearest could for example mean much shorter outage for a customer. The positioning of the service technicians through a web-browser (by sending GPS-coordinates continually) would therefore be of highest interest. Some discussions about personal integrity were addressed with the union representative, but could be agreed upon on behalf of employment safety. For safety reasons a personal alarm would also be valuable. A service-agreement with a professional alarm-service was established, since there were no dispatch or control function to follow the technicians.

GPS Navigation

Getting the help of a commercial GPS-Navigator, was also one of the prioritized functions. The Navigator from TomTom was included in the solution, containing maps over Sweden with most roads, apart from small dirt roads. If the coordinates of the network substation or customer could be included in the workorder, it would be very handy to export them to Tom Tom or GIS-maps in Mapinfo. This function was also included in the solution. The coordinates could be a fixed attribute to the functional location in R/3, or registered manually while creating a Notification.

Maps with network information

The quite complex process of putting together background maps with information about the electrical network was thoroughly worked through in the Mapinfo environment. The next step was to optimize these maps for the more limited performance in the PDA, which means reducing several layers of information, optimized for the needed areas. In these maps the service technician could in detail see how the network was connected, right there in the field. Using the information in the GIS Geoset, to perform a search for an asset or a customer, would be very useful.

General time reporting

Not included in the first phase, but of course vital in the long run, the general time and cost reporting functions were listed in the use cases. One of the reasons to postpone this in the first roll-out was that the service technicians had a complete time and travel reporting portal within R/3, also for salary, and this was not yet supported in the MAM.

THE PROJECT AND THE EXPERIENCES

The project directives were, after the first pilot tests, set really high with the goal of providing this solution to the majority of the service technicians. The pressure from the organization was very high with demands for a quick implementation. The IT-support of the platform, as well as installation and deployment were to be done by Vattenfall's own IT-company. The directives were also clear about that it was an implementation, not development of new functionality. During the validation the number was reduced to 30 to get a reasonable amount but also many enough to get experience of how a higher number of PDAs would be.

The first rollout phase included 15 technicians. Since GSM-cards had to be personal, it took some time to get everything installed and tested before hand-out and education. This was the first experience of the rather complex logistics of PDA rollouts. The education-material as well as the education was done by members in the project-group, who had been building up experience of PDAs during the last couple of months. A one-day rollout and education was planned, the basic functions in the PDA and the software were gone through. We immediately noticed that the technicians responded very individually to the new equipment. Some were very interested and learned quickly, but several were distressed by the situation of learning the PDA together with ordinary work. The environment itself (Windows Mobile) takes apparently a while to figure out, and also to become familiar with the hardware.

The first problem encountered in the project was intermittent failures in the connection from the PDA to the backbone. In areas with not full GSM/GPRS coverage, the PDA could get in to an abnormal state when sending or receiving data. Soft-boot was the only way to get the PDA in shape again, and this could take a couple of minutes. After some investigation, an error was found in the VPN-program, which did not handle failures in the communication-layer correctly. The frequency of sending coordinates from the PDA was also reduced, which had positive effects.

Functionality

Validation of the functionality was done using about 70 testcases, from easy to rather complex:

SAP MAM was the most difficult since it also demanded a backbone administration of job planning and dispatching. The system itself was rather slow and demanded accuracy and patience from the user. Problems of synchronization lockups occurred, but after some time it worked better. The system worked, but the application was not fully designed for PDAs only, and had too small menus and hypertexts. The seamless integration with the backbone R/3-configuration was however very positive, since no extra programming was needed.

Positioning the technicians in a webbrowser also worked but had problems from time to time. One was the enormous amount of GPS-coordinate-history, which had to be cleared once in a while. In reality, it seemed that there were no personnel who had a natural need for the positioning functionality. The background map, however, in which the technicians were positioned, was by itself more interesting, since it made it possible to visualize and locate assets to different customers to Vattenfall Service, in the same map. Alarm was only tested in planned testwork. It worked, but the XML-integration to the SOS service was not to become implemented during the project.

Navigation was very popular, and the function was always the first to be tested. But when the maps were about to be upgraded, the next version needed more flash memory than what was built into the tested PDA. An attempt was made to solve this by cutting the maps. Unfortunately, that didn't work.

Maps in the PDA was the function that had the most positive results in the tests. The possibility to search for objects and customers as geographical objects in the GIS-map, viewing the target together with the actual personal GPS-position, was very exciting and well received.

For the more complex test cases, that involved serviceorder connected to assets with XY-coordinates, planning process, navigation and reporting of job-details, tests were only made in the project group. There were simply not enough well defined processes implemented in the organisation to get this really tested.

Technical issues, installation and deployment

Already in the start, it became obvious that the installation process with all these different components were really complex. The installer was soon to be a critical resource. The security components demanded personal configuration, which stopped lending out a PDA to a colleague. Also there were a lot of quality issues with the hardware, often due to battery deficits. And since some components in the PDA were not stored on resident memory, a lot of reinstallations were to be made. The lack of some kind of 'installer workbench' became increasingly a huge problem. Also in the first rollout, there was no memory encryption in the PDA, as the rules within Vattenfall demanded. Later on in the project, a software from Protect Data was tested positively.

Batteries were another big issue. The battery-consumption was highly dependent on which functions were used. In the PDA all started programs are running until manually shut down. Without some experience of this the batterytime could be reduced from about 6 hours down to 2. The GPS had some tendency to disconnect from the CF-slot, which also made the PDA unstable. These and other practical issues of the PDA were several during the project. The weather-safe Recon 400 was not small enough to fit in most jacket or belt pockets. In the car it was placed on a holder, with separate 12V connection. This worked fine, but the technicians often left the PDA there.

After about 5 months, the next 15 technicians were chosen,

and the next rollout phase started. This time the members of the project were significantly more prepared and experienced, and performed the education and deployment much better. It really takes quite a while to learn how to implement a PDA solution.

Organizational and strategic issues

The implementation of the PDA solution had many implications on the organization. This was well prepared using information, questionnaires etc. Still, there was a lot more to be done to make the implementation work well. The ordinary planning and follow up processes were differently organized. The best result was either with those working with customer service and with well defined routines. Also work with planned preventive maintenance was possible to implement. Hardest to implement was the process of immediate corrective maintenance. Here well defined and complete dispatching processes (including the asset owner) were lacking.

A great result was the change in attitude from those technicians who quickly felt empowered by getting the device. Several of them immediately wanted to get their tasks in advance, to be able to plan the week more efficiently. The focus on the field workers also made some work leaders less sure of their role and position. In the local office they were often used to have the short term plan in their hands alone. For the Vattenfall group, a very positive reaction was noticed by stressing the IT-issues of the field technicians rather than the office personnel, as it usually is.

The project, as one can read in this paper, was in many ways surprised by the number of technical issues and obstacles that became evident in the implementation. The expectation was that the PDA technology would be much farther developed than what was experienced.

The greatest result from this project however, was the use of GPS, maps with network and customer information in PDAs. This empowered the technician significantly. The general focus on the technicians was very positive, both internally and externally. For general workprocesses, parallel tests on PC-laptops with SAP MAM proved to be much more stable and gave the technicians a good general tool for the service process as well as maps, although lack of navigation, positioning and alarm. Together with maps, the laptop would work fine.

The analysis of the costs involved in this project, pointed in the direction of about 200 euro per month and PDA, which was considered high, higher than the cost of a laptop. The cost of the project was after about 8 months also a problem. Apart from the costs, one major issue was changes in the backbone system strategy at the biggest customer, the distribution company within Vattenfall. Workorders for preventive and corrective maintenance were decided to be administered outside SAP, which also had a negative impact on the rollout. In May 2006, a decision was made to put the project on hold.

Windows Mobile

The platform of the Mobile Workforce-project was Windows Mobile 2003. During the spring of 2006, version 5.0 was released, containing several important improvements. This led to several contacts with Microsoft. In this dialogue, a lot of information was received that would have made a difference in the early platform design. The biggest mistake made was to include too many different applications in the PDA. The technology of the applications also has to be considered, since it was not recommended to mix too many technical environments in the PDA (Java, .Net etc). Scaling up memory and performance would not be a good solution since it shortens battery time. To run an application via IE in the PDA would also not be recommended, since the PDA IE-version had several limitations. Windows Mobile 5.0 has improved the PDA a lot, but is generally optimized for only a few applications, built on .net. Security solutions for PDA, such as VPN and memory encryption are very new and not tested a lot yet. The lack of standardization of the PDA hardware, which leads to hardware dependency, is maybe still the greatest obstacle. The only way to get a full warranty for a PDA solution is to have one vendor that provides both hardware and software. Maybe this will be improved in future releases of Windows Mobile, but this is also dependent on the market growth of mobile phones using Windows Mobile.

PDA's for meter exchange.

During the spring of 2006, a parallel project using PDA's for meter exchange in AMR-rollouts was started due to a large business agreement. Here the scope was a lot different. A solution that had been developed especially for changing meter readers, was offered as a complete IT-service by a Swedish vendor, Skvader systems. The system Rolf, uses a backbone database that handles workorders containing information of changing and calibrating meter readers. The complete IT-system is placed outside Vattenfall network, which decreased the demands for security components in the solution. The meter data is imported from a Meter-database with coordinates and customer information. Based on the coordinates, the workorders can be planned using the map from a web-tool, and then dispatched to the technicians.

The technicians log into the system from the PDA, provided from Skvader systems, and checks out his workorders. After reporting change information and meter values, as well as photographs, he logs out in the evening, and the workorders are checked back to the system. This would empty the PDA from information, which would not demand VPN or cryptation software. After a validation period of about 6 months, the system is planned to be implemented for a total of 100 technicians, using it for the AMR-rollouts. The hardware tested now is HP IPAQ with GPS, which is a lot cheaper than ruggedized PDA's.

CONCLUSIONS AND RECOMMENDATIONS

The focus in these projects are the service technicians and their ability to work more effectively using IT-tools. The experiences of the projects lead to the following recommendations:

As a general IT-platform, PDA's cannot be recommended as they do not have the capacity for the needed number of different applications used. The PC-laptop will instead be the best and cheapest tool for general IT-solutions, using online connection via GPRS or 3G, or using online/offline solutions such as SAP MAM.

For special tasks, the benefit of having the information in one hand, while operating with the other, implies PDA's based on Windows Mobile 5 or later. But these applications must be specialized for the purpose that they are used for, such as operation on Meters, Cable boxes, Poles and so on. Of special interest from the project Mobile Workforce is the well working GIS software with maps and NIS-information. Although some security demands have to be eased, this tool will be very popular.

In the case that the PDA should communicate with ERP-system, the PDA software and backend controls should be a separate system, communicating to the ERP using modern integration techniques. This enables more freedom of designing the PDA-software, and also to be more independent of ERP changes, such as upgrades.

The results from the parallel project for meter exchange recommends an "out-sourced one-vendor-solution" including hardware. The costs are at least the same as in the "in-house"-solution, but the efficiency of the implementation is higher. The negative part is the risk of being locked in with one system provider.

Office PDA's will probably be chosen instead of ruggedized devices, due to cost reasons. The alarm-function can now be available from SOS-service vendors, based on the GSM mobile phones. Commercial GPS-navigators can also be a good choice, if they support navigation to coordinates entered manually into the device.

The experience of the implementation also points towards more specialized roles and work processes, where the personnel has to cover a larger geographical area. This leads to more specialized technicians that also are more self-going and providing quality assured information to work leaders and customers. To optimize their daily work schedule, they also have to participate in the job planning process.

In the short term, the cost for mobile IT will be fairly high and many technicians will not be able to handle the IT-tools as expected. But as we face a great challenge with experienced technicians retiring of age, we need several new tools to make the technicians work more quality assured and effective. As office personnel use PC every day, sooner or later this will also be the case of the service technicians.