Mobile Technology for Electricity Field Services Personnel

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Purpose

The purpose of this paper is to describe how the City of Cape Town Electricity Department is using mobile technology to manage fault reporting by the public (citizens) and subsequent work distribution to the First Line response technicians. The paper will review the project background, outline the old and new processes, review the drawbacks of the old process, and highlight some of the benefits of the new system using mobile technology as well as issues to be considered when implementing a mobile solution. The paper will also discuss some of the initial challenges encountered with the rollout and will briefly highlight future considerations for mobile applications at the Electricity Department.

1. Project Background

In May 2010, the decision was made to replace the current paper-based system with a mobile alternative. This was following a successful pilot project where the mobile technology was tested in the field using a limited number of crews (3) to receive and update their Service Notifications electronically via handheld devices. Some of the main problems with the paper-based system that led to the decision to evaluate and implement a mobile solution were:

- Fault report cards were cumbersome to deal with and wasted a lot of paper;
- Fault information was normally relayed via radio by the shift supervisor to the technicians in the field who in turn filled out a work sheet. At the completion of each job, the relevant work sheet was completed with information such as time taken to complete the job, what the problem was and what was done to correct it. The completed work sheets were then brought back to the depot at the end of each shift for entry into the system by a depot clerk. This resulted in a delay in the reflection of the true status of the problem in the system as well as job loss due to travel time;
- The depot clerks are generally overloaded with work and data entry was sometimes not attended to immediately as it was perhaps seen as a lower priority. This resulted in a delay in capturing the data, or at worst, not captured at all. There was also a possibility that the clerk could enter the data incorrectly causing various problems in the system of which data integrity is one of them.

In order to assure a consistent business process across the City to deal with the Service Notifications, a Corporate Works Management Process (CWMP) was established. This process gave business entities across the City a standard way to manage Service Notifications which is a critical success factor in the implementation of a mobile solution. It is imperative to note that a mobile solution will not solve broken business processes and should not be considered unless you have an established business process. Another critical item to ensure full utilization of a mobile solution is that the Master Data should be reflected correctly within the system and should be included when designing the Business Process.

2. Old Paper Based Process

2.1. Old Paper Business Process Flow

The old paper business process consisted of 10 distinct steps
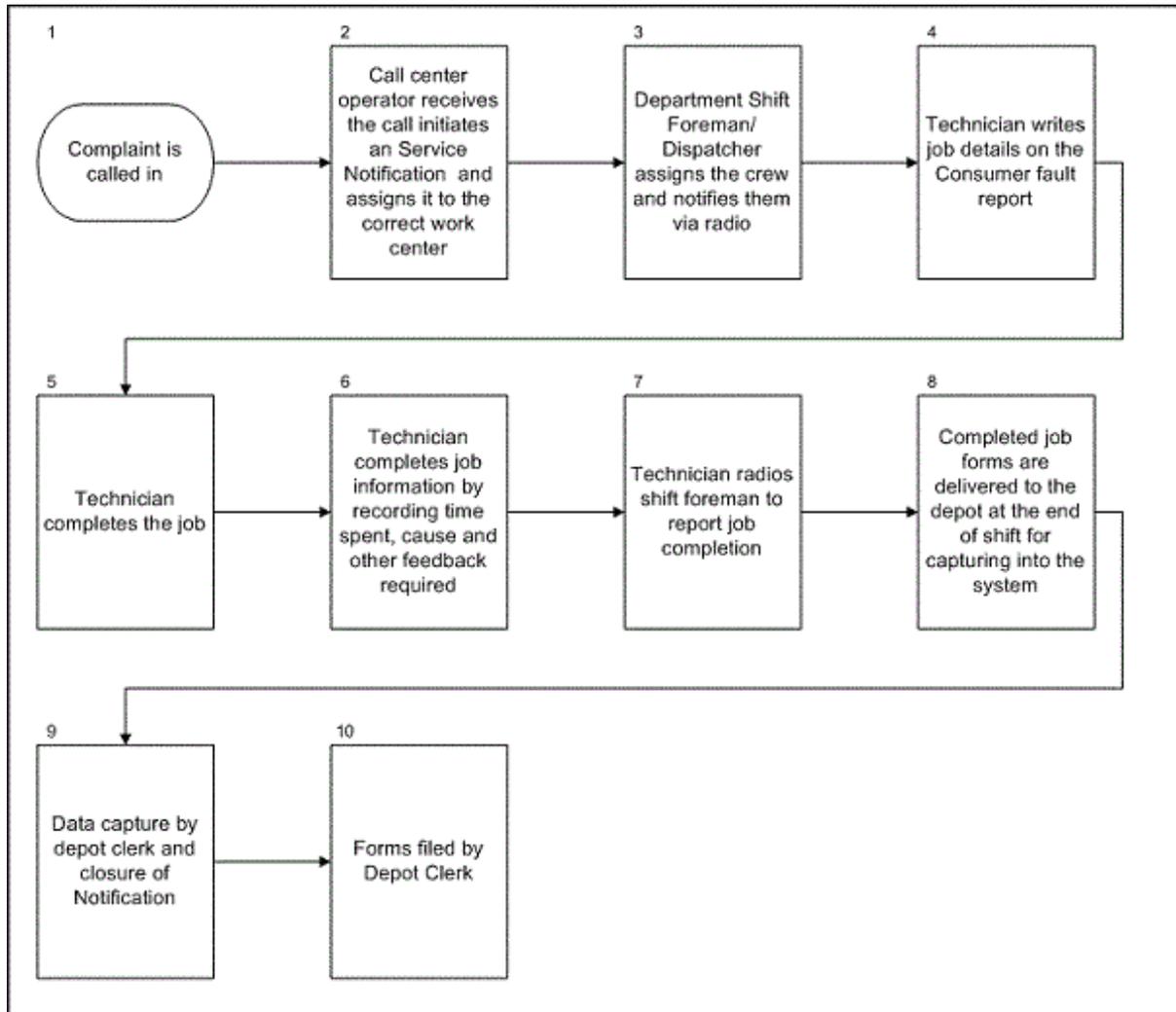

Figure 2.1

2.2. Process on paper for the Technician

The paper process required the technician to write the job information (received via radio) such as Notification Number, Fault Detail, Consumer Name and Address on a fault report (job card) form. After the work is completed the technician completes the fault report form to capture items such as the start time, end time, damage and causes. The fault reports are then brought to the depot after the shift for capture by the data entry clerk. See figure 2.2 for fault report layout details.

CITY OF CAPE TOWN : ELECTRICITY SERVICES : CONSUMER FAULT REPORT

No: 241828

A — CONSUMER DETAILS

Notification no.: _____ Fault detail: _____
Consumer name: _____ Street name & no.: _____ Suburb: _____
District: _____ Supply (kiosk no. etc): _____ Vehicle reg. no.: _____ Type of vehicle: _____ Km: _____
Staff attend: _____ Staff no: _____ Start time: _____
_____ Finish time: _____
_____ Date: _____

B — TECHNICAL HISTORY

OBJECT			DAMAGE			CAUSES		ACTIVITIES	
□ Busbar	□ Gland	□ Pole	□ Blown/Burst	□ Keypad Failure	□ Power Light On	□ By-Passed	□ Leose Connection	□ Rodents	□ Replaced
□ Bushing	□ Hinges	□ Prepayment Meter	□ Breaker not Tripping	□ Label Removed	□ Punctures	□ Consumer Fault	□ Maintenance	□ Safe Switching	□ Reset
□ Cable	□ Insulator	□ Stay	□ Broken	□ Load not Detected	□ Ripped	□ Corrosion	□ Moisture	□ Setting	□ Rewired
□ Cable Box	□ Kiosk	□ Stayguard	□ Burnt	□ Malfunctioned	□ Seals Removed	□ E/Leakage	□ Negligent	□ Short Circuit	□ Temp Repair
□ Cable Joint	□ kWh Meter	□ Streetlighting	□ Contactor Failure	□ Negative Balance	□ Stolen	□ Excavation	□ No Maintenance	□ Software Problem	□ Tested
□ Circuit Breaker	□ Load Control Relay	□ Switchgear	□ Continuous Noise	□ No Display	□ Temper Flag On	□ Fatigue/ Ageing	□ None/Private	□ Theft	
□ Conductor	□ Lock	□ Termination	□ Cracked	□ No Display < 50 units	□ Temper Plgs Removed	□ Faulty	□ No Sequence	□ Token not Accepting	
□ Connector/ Clamp	□ Lock device	□ Wiring	□ Cut off	□ None	□ Torn	□ Fauna	□ No Units	□ Vandalism	
□ Consumer Fault	□ Minisub/Tx		□ Damages	□ Physical Damage	□ Tripped	□ Fire	□ No Payment	□ Vehicle (Mechanical)	
□ Earthing/Spike	□ Ooslersee Box		□ DB Tamper	□ Pilot Cable	□ Worn	□ Flora/Trees	□ Overload		
□ Fuse	□ Overhead Supply		□ Exploded			□ Insects Infest.	□ Pollution		
□ Fuse Carrier			□ Fault Mode			□ Lighting			
			□ Flash Over						

Refer to: □ Revenue Protection □ Vending □ MV □ LV □ Public Lighting □ FLR □ Eskom □ Revenue Management □ Metering

Time referred: _____ Acknowledged by: _____ Material used: _____
_____
Remarks: _____

C — METERING REPLACEMENT DATA

Old meter no.: _____ Credit available/reading: _____ Tokens not punched in: _____
Total units consumed: _____ Seal no.: _____
New meter no.: _____ Type & Rating: _____
Changed by: _____ Signature: _____ Date: _____ Seal no.: _____ Complete (Yes/No): _____
Credit/Coupons transferred (Yes/No): _____ Token value requested: Units _____ R _____ Token generated @ SMS by _____

D — CONSUMER ACKNOWLEDGEMENT

I, _____ the undersigned, am satisfied with the service provided and with the number of units credited to my new Prepayment Meter (where applicable) NB: Please notify the Prepayment Meter Vending Section at Tel: 0800-220-440 of any unused electricity tokens not included in the above within seven days to enable the token to be processed.
SIGNATURE: _____ DATE: _____

Figure 2.2

3. New Mobile Process

3.1. New Business Process Flow

The new business process can be broken down into 8 distinct steps.
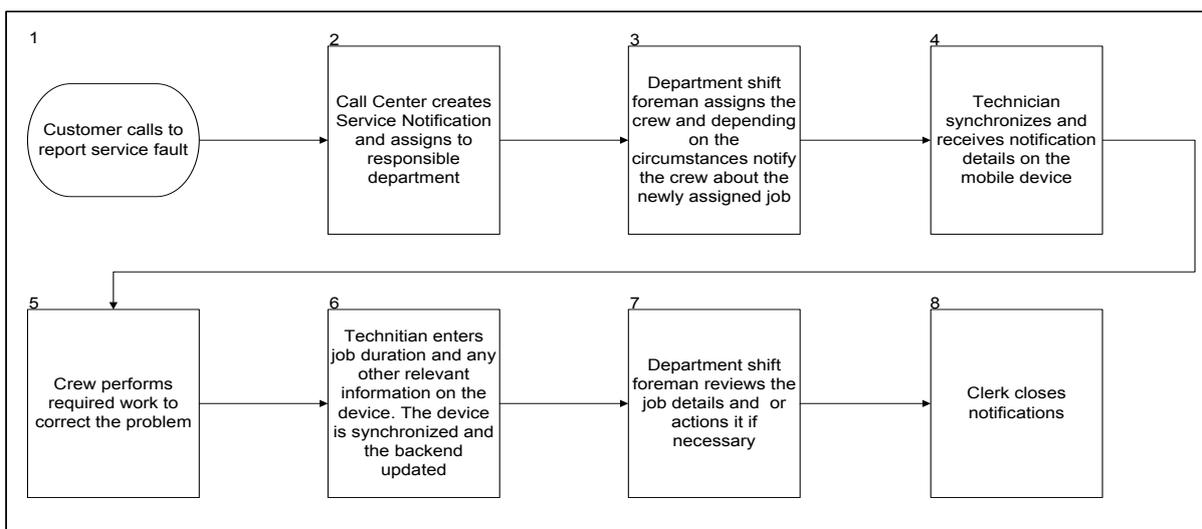

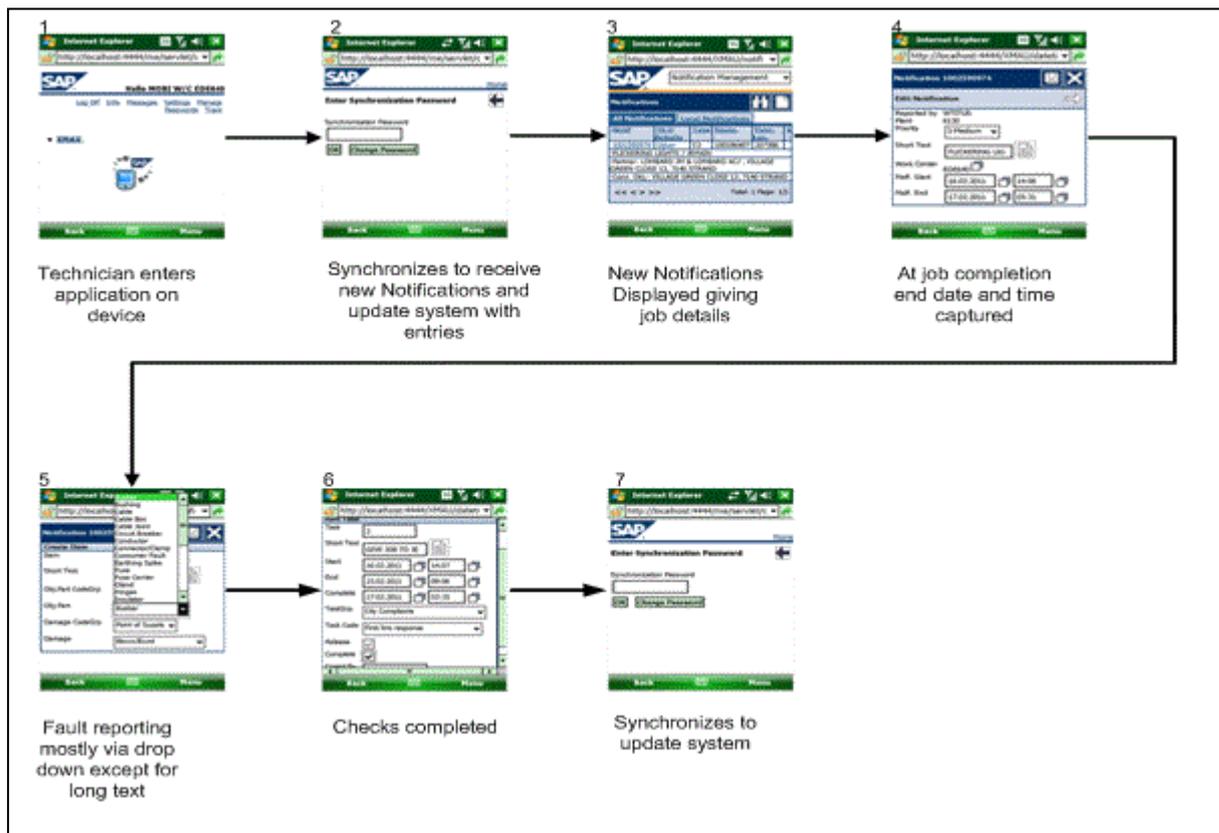Figure 3.1

3.2. Process on the mobile device

Figure 3.2

4. Benefits of going mobile

4.1. Reduced Paperwork

Approximately 2700 service notifications are created for Electricity First Line Response per month. With an average of 2 pages per work order, 5400 pages are normally printed per month. The mobile solution eliminates the paper usage, printing costs, and storage costs as well as helping the City to be more environmentally friendly.

4.2. Reduced man power

On average a clerk would take about 5 minutes to capture the data into the system and file the paperwork (excluding time needed should there be a query or to account for mistakes). At an average of 2700 Notifications per month the time needed to capture the data was approximately 225 hours per month, which is equal to a full time job for 2 clerks. By using mobile technology the workload of the clerks is estimated to have been reduced by 75%, thus freeing them up for other duties.

4.3. Reduced Cost

The tangible cost recuperation for implementing the mobile solution is estimated at 3.5 years with an estimated running cost of R65.00 per device per month. However, intangible benefits

such as improved customer service, reduced errors and a more up to date system status should also be considered when a decision is made to go mobile.

4.4 Reduced errors in data capturing

Mobile technology provides improved accuracy of captured data on two levels.

1. The educational level of the field personnel varies and because English is not always a first language, the job cards are not always completed correctly, and sometimes not all, causing additional delays due to the need for follow-up on the part of the capturing clerk. By making use of drop down boxes for input selections on the mobile application these errors are significantly reduced. The mobile application also validates the data upon synchronization and alerts the crew to the fact that there is a problem with the data which then enables them to correct it immediately.

2. Data was not always captured correctly in the system due to various reasons such as typing errors or inability to read what was written on the job card.

4.5 More up to date status of the Notification in the system

When the crew synchronizes the mobile device with the system, the system sets a status on the Service Notification to indicate that it has been allocated and received by the crew assigned to do the work. A status of" **MOBI**" is assigned to the notification. A message "This Notification was copied to a mobile device" is also displayed, thus giving any user with access to the system information regarding the status of the Notification which also aids in customer feedback.
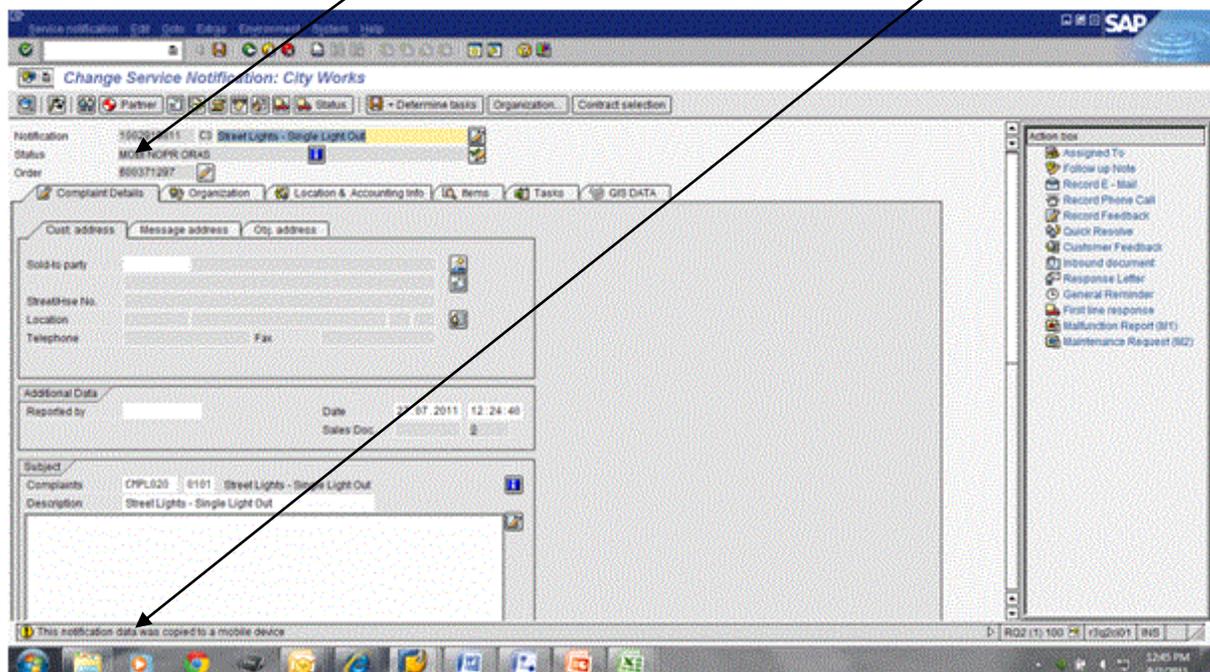

Figure 4.5A

The system is updated almost immediately after a job is completed. The chart below compares the difference in the number of days to close a Notification between the paper-

based system (blue) and the new mobile system (red). The chart compares Notification data for June 2010 (pre-mobile) to June 2011 (post-mobile). The total average number of days needed to capture the data in the system after the job was completed for the month of June 2010 was 2.63 days compared to 0.15 for the same month in 2011. This represents a difference of almost 2.5 days with the peaks reflecting weekends when the difference is higher. The ability to capture data in near real time results in better management because the true status of a Notification is reflected. Figure 4.4B gives a graphical interpretation of this.
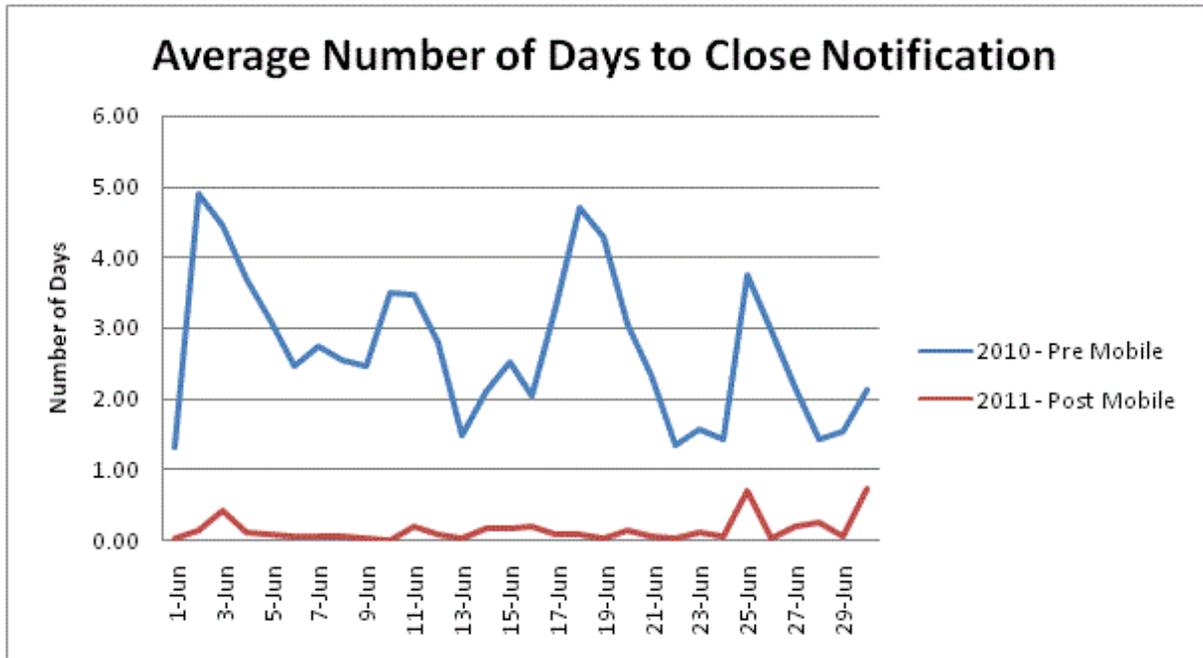

Figure 4.4B

4.6 Reduced travel time

The City's first-line response teams are mostly manned by outside contractors (4). By going mobile, the need for them to travel to the depot to deliver completed work sheets has been eliminated, allowing for more time in the field for problem resolution.

4.7 Guided to follow established business process

Having a mobile application guides the technicians to follow the established business process. The ability to take "short cuts" is eliminated since the mobile application will not allow a job to be marked completed unless all the required steps have been completed.

4.8 Changes to master templates done centrally

Whenever a need occurs to update a master template it can be done centrally with the device being updated during the next synchronization. This negates the need to re-print the fault report sheets saving money and time.

4.9 Notifications remain on device till completed

Once a fault is assigned to a technician it will remain on the device until completion or re-assignment to another crew should the need arise. This allows for better management of the work by the crews and eliminates jobs "falling through the cracks."

5.　Challenges converting from a paper based solution to Mobile

The overall acceptance of the mobile devices by the field team has been very favourable. There was initial resistance by some of the technicians (mostly because of lack of familiarity with the device) but after a couple of weeks of using the mobile devices all of the field personnel preferred the mobile solution over the paper-based system.

The majority of problems encountered after the rollout can be grouped into the following:

- Incorrect Password entered;
  We had some initial problems with technicians not remembering their passwords or getting used to the device with touch screen keyboard sensitivity. Sometimes the caps lock was also selected inadvertently.
- Device not connected;
  Occasionally, the technician might forget to establish a link between the device and the back end system causing the device not to synchronize.
- Application Usage Problems;
  Overall, the technicians had few problems adapting to the mobile solution. The screens on the mobile device had the same structure as the fault report form that they were used to completing which made training in the use of the mobile device very easy. This is another reason why it is so important to have a business process in place before going mobile.

6. Way Forward

Mobile Technology is still in its infancy at the City and the decision was made to use a phased approach to rolling the technology out to the technicians in the field. The City's Electricity First Line Response support structure is divided into 3 areas (East, South and North) which are further subdivided into Public Lighting (single light outages) and minor Customer related outages. The first phase consisted of rolling out 10 devices to First Line response area east. We are currently in the process of rolling out the mobile system to the rest of the areas with a total 81 devices planned for roll-out by the end of the current financial year.

Future enhancements to the mobile solution will include:

- The ability to attach a picture to a notification for record keeping;
- The ability to display the incident geographically on the device. The Customer call centre currently captures the incident geographic location on the service notification and is available for display on a map by the shift foreman. We want to extend this to the device;
- Sending of an SMS to the device whenever a new service call is initiated for the crew. This is currently done by the Shift Foreman via radio;
- Sending of an SMS to the Customer when the job is completed; and
- Developing a new application that will allow for field inspections.

7. Considerations

The following considerations should be taken into account when implementing a mobile solution.

7.1. A Business process must be in place

One of the most critical success factors for implementing a mobile solution is that the business process must be well defined and implemented. At the City a Corporate Works Management Process was established to deal with all service notifications. The process was then rolled out to the different departments to ensure a uniform process throughout the City.

There must also be a backup system in place should problems such as network outages or system downtime occur.

7.2. Device Selection

Select a device that is suitable for your working environment. Ruggedized devices are more durable but are also more costly. During our pilot project we started with a requirements matrix to define what kind of characteristics the device should have such as durability, screen size, environment in which the device will be utilized, modes of connectivity, ability to take pictures, GPS enabled, etc. We technicians then tested different brands of devices which adhered to our requirements during the pilot and the device with the highest marks was chosen purchased.

7.3. Training

Ensure that adequate training is provided to the technicians. It should be expected that they might be apprehensive in adopting a new way of doing their jobs and the mobile devices could even be found to be a little intimidating for people that are not used to them. The better they are trained on the application and use of the device, the more receptive they will be to using it.

There were a few technicians that had an initial resistance to using the mobile devices but it was more a fear of the unknown than a resistance to the process. Our experience indicated that even the least skilled of the technicians were able to use the device after training. In some cases we had to provide some additional training but since most people are used to using cellular phones and sending SMS's the adaption to using our mobile devices were relatively easy.

After a few months of using the mobile devices all of the technicians were in agreement that it simplified their reporting and nobody was in favour of going back to the paper based system.

7.4. Support

In order to successfully implement a mobile solution, adequate support is necessary. In addition to a manual with instructions on how to troubleshoot and correct the most common problems, we have also established a support group that provides field support during the initial rollout. Field support is not always practical when the technicians are not close by and

we are currently evaluating software to remote assist those technicians should they have any problems.

7.5. Keep initial project small not mission critical

Implementing new technology is always challenging and the introduction of a Mobile Solutions is no exception. By doing a pilot project with a limited number of devices, we were able to resolve all of the major issues and correct procedural breakdowns before rollout to the rest of the City's First Line Response. Technicians had the paper based solution as backup should any problems occur thus no interruptions were experienced in our service delivery. The decision was also taken to do a phased rollout to ensure maximum support during the rollout. This phased rollout also ensures that we do not move on to the next group unless the current group is stable.

7.6. Connectivity

A decision must be made on how the device will be connected to the system (wireless LAN, cellular network or docking station). One of the main factors that would influence the decision would be the criticality of having real time update capability or if the need is only once per day. Since we wanted near real time the decision at the City was to make use of GPRS connection via a 3G card in the device.

8. Conclusion

By implementing a Mobile Solution for the management of Service Notifications, the City is not only able to provide better service to the customers, but is also able to better manage and report on the status of Notifications. Data capturing errors have been significantly reduced, and there has been a reduction in the manpower required to do the data entry. The reduction in time needed to enter data has allowed the clerks to spend more time on other essential tasks. It must be emphasized that we would not have been able to do this if our business process was not previously defined and in place. Our overall experience has been a positive one and we have already identified other mobile opportunities that will lead to overall better business practices and cost savings.