ETHEKWINI'S MUVO CARD: A FIRST FOR SOUTH AFRICA

MICHELLE PEARTON and MIKE HUGHES*

eThekwini Transport Authority, PO Box 680, Durban, 4000
Tel :031 322 7172; Email: michelle.pearton@durban.gov.za
*Beyond Payments, a division of Standard Bank, 89 Central Street, Houghton, Johannesburg, 2000
Tel: 011 489 3304; Email: mike.hughes@standardbank.co.za

ABSTRACT

The aim of the National Department of Transport's (NDoT) Integrated Rapid Public Transport Network (IRPTN) is to create a good quality public transport system that meets customer needs. A key component of convenient public transport is an integrated fare management system. The eThekwini Transport Authority has recently developed and begun roll-out of its "MUVO" card, the first fully EMV-certified (Europay, MasterCard and Visa) and NDoT-certified smart card. The objective of this paper is to outline the process that was followed to develop the card, the main challenges faced and the key lessons learnt in this first phase towards the implementation of a fully integrated fare management system.

1 INTRODUCTION

1.1 Background

The eThekwini Transport Authority (ETA) is in the process of reorganising public transport within the City of Durban to ensure that a sustainable, safe and efficient service is delivered. The overall goal of this initiative is to improve the quality of life for the city's residents through the provision of an Integrated Rapid Public Transport Network (IRPTN) that is safe, secure, convenient, clean, affordable, and socially equitable. This service will ultimately be in line with Government's public transport action agenda, as approved by Cabinet in 2008, where all the major cities have been mandated to create and implement fully integrated public transport networks over the next 15 years.

The ETA has completed a wall-to-wall plan for the project that has yielded a public transport system with special features that are currently not available in the existing system. The network will comprise an integrated package of rail and bus rapid transit and trunk routes with dedicated right of ways (ROWs) for the public transport vehicles. The system will also cater for special needs and wheelchair access in most trunk-corridor rail and road vehicles. The network comprises a number of elements including the following:

- Nine main transport corridors with associated trunk routes, feeder routes and complementary routes. (Trunk routes are high capacity public transport routes that enjoy priority travel through the transportation network. Feeder routes are public transport routes focussed on enhancing accessibility to the trunk routes by extending the network coverage. A trunk route cannot be taken to every doorstep neither can commuters be expected to make unnecessary feeder to trunk transfers,

hence the need for complementary routes that serve a particular origin-destination pair, where demands are high enough to provide a more direct routing by avoiding transfers.)
- Transfer stations.
- "Park and ride" facilities.
- An electronic fare management system (EFMS).
- Non-motorised transport facilities, including bicycle lanes.

The implementation of the EFMS is part of the broader suite of the overarching Intelligent Transportation Systems (ITS) architecture that will be implemented to support public transport management. ITS can be described as any application of communication and electronic devices to enhance the management of the transportation system to achieve greater efficiency and effectiveness (New York DoT, 1999; US DoT, 2012).

1.2 Problem statement

The implementation of a new EFMS is one of the first initiatives within the IRPTN programme that is underway. The system has been implemented in the eThekwini Municipality's existing bus services and will be rolled out to other operators and modes of transport in future.

The payment transaction method for public transport has changed from paper-based bus coupons to a contactless EMV "smart card". The EMV Card initiative has been driven by the National Department of Transport (NDoT), in conjunction with member banks of the Payments Association of South Africa (PASA), and in the case of eThekwini Municipality, Standard Bank. NDoT requires a specific data structure to be hosted on the smart card, which utilises specific tags on the EMV chip of the bank-issued fare media for electronically recording and retrieving public transport related data. NDoT's vision is to regulate the use of EFMS's in public transport nationwide to allow for full interoperability across all modes of transport.

The ETA has branded their EMV smart card "Muvo" and it will be referred to as the Muvo card hereafter.

The motivation for installing the Muvo card for eThekwini Municipality's public transport services was based on the following key issues:
- The ticketing system installed had become obsolete and costly to maintain as spare parts are no longer available.
- The system could only handle paper-based pre-paid fare cards. This is open to abuse as forged tickets are on the increase.
- The management information system was outdated and unable to provide the required information.
- The requirement to comply with the regulations governing integrated FMS's in the NDoT, National Land Transport Act (NLTA), 2009.

1.3 Aim and scope of paper

The objective of this paper is to outline the process that was followed to develop and implement the EFMS, to highlight some of the key challenges faced, lessons learnt and opportunities that still need to be explored to enhance the commuter experience and to extend the EFMS to meet the needs of the IRPTN.

2 OVERVIEW OF NDOT REQUIREMENTS AND THE MUVO CARD

The critical elements incorporated into the roll-out of the Muvo card are compliant with the requirements of the NLTA, 2009 (Act No.5 of 2009). The Act requires that fare payments must be made through any bank-issued fare payment system and be interoperable through all participating banks. Commuters with bank accounts should be able to use their bank cards and commuters without bank accounts should be able to use prepaid cards. NDoT's automated fare collection (AFC) data structure must be loaded onto all EMV cards to be used for public transport fare payment, both bank account linked debit cards and pre-paid cards. The Act also calls for data to be collected electronically via the AFC system for the purposes of planning, monitoring, subsidy management *etc*.

The Muvo card is EMV-certified, fully complies with NDoT's requirements, and has been certified by Techso (Pty) Ltd in association with Keith Smith Consulting CC, the compliance agency appointed by NDoT to carry out certifications and issue letters of certification. The card is branded with the "MasterCard Cash" and "PayPass" brands and loaded with a prepaid debit wallet and the NDoT data elements. These products allow for the following:

1. Cash may be loaded into the prepaid debit wallet which can be used for the payment of a transit product when boarding a bus (for example). Alternatively, the wallet may be used to pay for goods and services at traditional retail outlets equipped with a credit card acquiring device supplied by any South African bank.
2. Travel products may be loaded into the NDoT data elements on the card, replacing the traditional coupon service and allowing the commuter to load up to three different travel products on the card. These travel products may span up to three different operators. This capability will provide the customer with all the financial benefits of the traditional coupon system with the added convenience that they do not have to carry multiple credentials for use when moving between operators and services.

3 PROCESS TO DEVELOP AND IMPLEMENT THE MUVO CARD

Whilst the technology is a key enabler of a successful EFMS, the implementation of the Muvo card required a structured approach to effectively manage all facets needed for the system to operate successfully. This included the development of a new operating model, organisational structure, policies and procedures. The implementation was also supported by change management and marketing interventions.

3.1 Technology

The appointment of the Almex and Standard Bank consortium was through a tender process and the consortium took responsibility for the development of the EMV solution and implementation of all ticketing equipment. The solution to provide a pre-authorised low value transaction in an offline mode on an EMV platform, utilising the AFC NDoT structure is a world-first. Almex and Standard bank worked together to provide a solution that incorporated existing paper-based transit products, with which commuters were familiar, into the NDoT structure.

All systems components of the Muvo card needed to comply with the stringent security requirements of the banking industry (Standard Bank in particular) and of EMV. These requirements ensure that the data involved in each transaction are encrypted and kept securely at all times, thereby ensuring the integrity of the transaction. In addition, hardware

encryption devices have been installed within the Almex Optima (Optima stands for “Open platform ticketing machine”) which allows for the addition of authentication codes to all the transit products.

The solutions comprised of the following key components:

A. Installation of Fare Management System on approximately 550 buses, including:
    i. Almex Optima ticketing machine – functional and rugged hardware present in an industrial design with a fast ticket printer and user friendly touch screen running embedded Microsoft Windows CE and designed for easy integration in the driver’s cab.
    ii. Installation of Security Access Modules (SAM) into the Optima to encrypt transactional data at source and enable secure data transfer to Standard Bank.
    iii. On Track Innovation (OTI) Readers – MasterCard certified and globally recognised as a leader in contactless microprocessor-based smart card solutions.
    iv. GPRS/GPS Antenna.

Figure 1 – Tapping the Muvo card against the OTI reader

B. Installation of the Muvo card point of sale equipment at 14 mobile and 14 fixed stations, including:
    i. SENOR point of sale kiosk machines and Verifone readers for Muvo card activations, loading and balance enquiries. This included the development of an interface between the kiosk and Verifone reader.

Figure 2 – Muvo fixed station with point of sale kiosk and Verifone reader

C. Installation of back-office equipment, including the following:
    i. 14 Almex cashier machines for use at the depots to assist with cash-up of daily cash-takings on the bus.
    ii. 10 Almex despatcher machines for use at the depots to despatch drivers for duty.
    iii. Almex system administration and management information software.

Standard Bank and Almex handled the certification processes with MasterCard, and their expertise and experience in this critical process was essential. The certification process had five separate steps as follows:

i. OTI hardware certification. This involved the certification of the hardware, the operating kernel and the application that runs on the device. This is a standard feature that is supplied by OTI and as part of the support function they ensure that the environment continues to accommodate the standards published by MasterCard and EMV.
ii. Certification of the card. This had two distinctly separate steps. The first step was the certification of all the Muvo artwork to ensure that it met the stringent requirements of MasterCard. The second step was the certification of the chip parameters and setup to ensure that it functions in a manner commensurate with the MasterCard service standards.
iii. Card issuer certification. This ensures that the process of manufacture and issuing complies with the associations defined standards.
iv. Terminal Integration Process (TIP) certification of the on-board bus acquiring equipment. This is a process whereby a range of tests defined by MasterCard using cards supplied by them are conducted. The results and logs of these tests are then verified by MasterCard and, if correct, the certificate is issued.
v. Network Integration Validation (NIV). This involves the testing and sign-off of the entire deployment from transactional origination through to inter-bank settlement.

Standard Bank also handled the inter-bank clearing process which involved testing of Muvo cards on all the retail acquiring devices supported by all South African banks and verifying that transactions worked successfully from the customer to merchant and inter-bank settlement. This was an onerous process which involved changes at all banks and BankservAfrica (an organisation set up by all the banks to facilitate inter-bank settlements), to successfully process dual-message debit transactions for the first time.

The city's internal information technology department designed the systems architecture comprising of the following:

i. Fibre and wireless networks were installed from the central processing environment to the four bus depots to enable communications between the Optima and central servers once the bus returns to the depot.
ii. Production, research and development, training and disaster recovery application and database servers were installed at the relevant Data Centres. The Standard Bank Connect Direct Server was also commissioned to manage the secure transfer of transactional data between ETA's data centre and the bank.
iii. Installation of desktop computers for staff and management to access the Almex web-based reporting system.

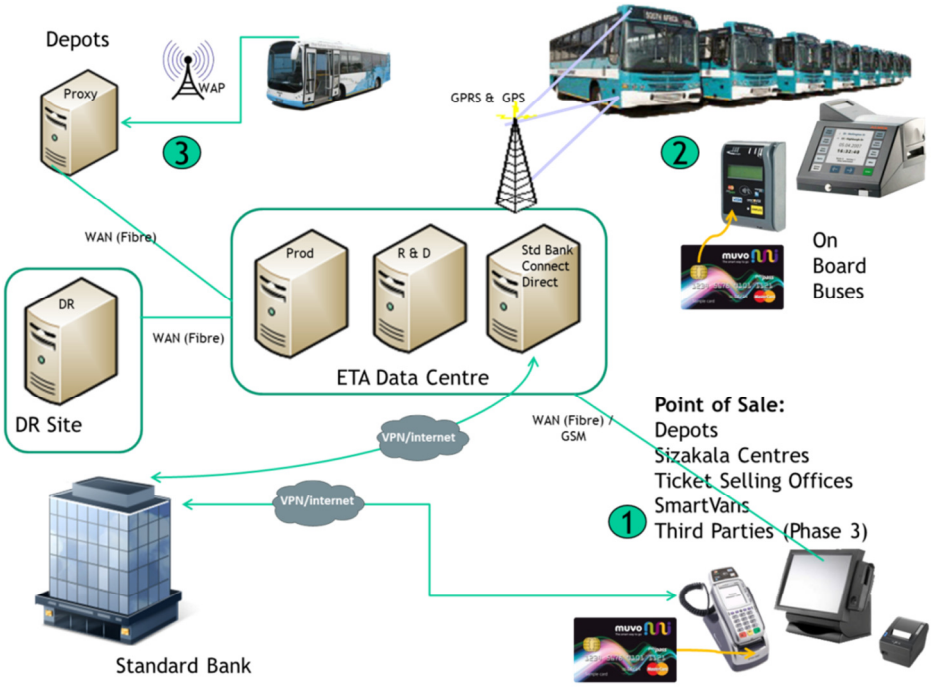

***Figure 3* - Overview of system architecture for the EFMS**

3.2 People and processes

This aspect of the project involved detailed definition of policies and procedures to address the key operational elements such as:

- fare structures and associated business rules,
- Muvo card management and point of sale,
- customer services,
- technical support and maintenance,
- Business continuity plans / disaster recovery and
- data collection and reporting.

In addition, a new operating model was required to enable the effective management, distribution and customer support for the Muvo card.

The introduction of new technology, processes and operating model introduced significant changes within the organisation that impacted a number of internal and external stakeholders. The success of the project relied on the extent to which the various stakeholder groups were able to accept and commit to the change.

PricewaterhouseCoopers was engaged to assist with the change management and marketing interventions that were required to effectively manage the stakeholder groups. The change management and marketing interventions were focused on the following four stakeholder groups:

- ETA employees
- Customer facing
- External
- Commuters and potential commuters

All key stakeholders within the above groups were identified and assessments were conducted on how best to engage with them, taking into account their various needs, their perceptions of the changes taking place and how they were being impacted. Thereafter, appropriate communication, marketing, advertising and education methods and fit-for-purpose campaigns were developed.

The change management interventions dealt with aspects such as training programmes for all staff on the technical and soft skills required, regular communications and forums that would enable staff and key stakeholders to engage and express any concerns or areas of resistance the needed to be addressed.

The first marketing initiative undertaken was to develop a brand identity for the Smart Card that would make the card exciting, visible and recognizable. The resulting card design is shown in Figure 4.

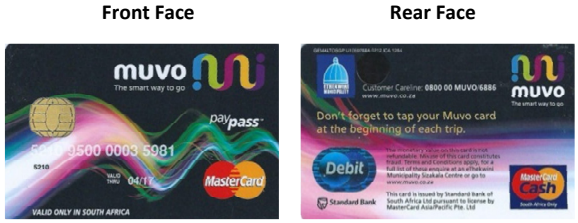

Figure 4 – The branded Muvo smartcard

The roll-out of the Muvo card was supported by an extensive education and awareness campaign, involving the following activities:

- Events at popular public gathering places to launch and promote the Muvo card.
- Media campaigns through newspaper and radio advertisements, press releases and interviews with ETA management on the radio.
- The use of Brand Ambassadors who travelled on the buses and were stationed at the Muvo kiosk points throughout the city, to engage directly with the public.
- Commuter surveys to gauge the effectiveness of all of the above and perceptions about the Muvo card. These surveys showed that the most effective method of reaching the commuter was through the Brand Ambassadors and word of mouth.

4 WHAT WENT WELL

The ETA and Standard Bank appointed independent dedicated project managers to oversee the implementation, who were able to focus solely on managing the project without being side-tracked by day-to-day operational issues and who could operate in the best interests of the project since they were not employed by either the key users or key suppliers of the system.

The technical solution from Almex and Standard bank was delivered with zero showstopper or critical defects encountered during either the user acceptance testing or pilot phase. This was achieved through a rigorous application development and testing process with the Almex Ticketing equipment system developers based in Germany, Standard bank, OTI and Verifone.

The project also enjoyed the full support of executive management and political leadership within the city, a critical success factor for a project of this nature. The effective leadership

enabled the project to receive the required level of commitment and operational expertise from the relevant staff within the Municipality.

The education and awareness campaigns to commuters was effectively achieved through the use of Brand Ambassadors who were given extensive product training and were stationed on buses and Muvo stations (where Muvo cards are activated and loaded) to disseminate information, assist commuters and deal with related queries and concerns.

So far the key benefits of the Muvo card have been improved provision of planning and management information, the capability to operate in a multi-operator environment and the system will enable integration of fares across various modes of transport in future.

Once the EFMS is completely rolled out, the city is expecting improved revenue collection, currently impeded by the incidents of fraud experienced with the paper coupons, and an overall improvement in transport services through the provision of better management information.

5 KEY CHALLENGES AND OPPORTUNITIES

The Muvo system has been up and running since May 2012 and apart from minor technical and operational issues the system is operating successfully. There have however been a number of challenges that have impacted on the uptake of the Muvo card, commuter convenience and optimisation of revenue collection.

5.1 Uptake

The appointment of the staffing structure required to fully service the Muvo card sales and distribution was delayed due to lengthy internal processes within the Municipality to approve the organisational structure and recruit staff. This resulted in the need to appoint a temporary staffing structure providing the service on a limited scale. This has impacted on the uptake of the Muvo card as the full service requirements are not being met.

Whilst the Brand Ambassadors perform a key role in terms of first line communication to the commuters, until recently there was insufficient capacity within the project team to respond quickly to communication needs of the public at a broader scale. This often resulted in frustrated commuters and the need to perform damage control on the ground.

5.2 Commuter convenience and acceptance

5.2.1 Public acceptance

The Muvo card has enjoyed wide-spread acceptance by the public who see the card as safe and convenient, making it easier for them to budget for their travel. A survey was conducted with a sample size of just over 2000 commuters showing that whilst the majority (81%) of commuters have no objection to adopting the Muvo card once paper coupons are discontinued, the small percentage that do object have indicated that the drivers are resisting the use of the Muvo cards on the buses and are not operating the on-board equipment correctly so that some commuters are unable to use their cards on the bus. Of the commuters that are using the Muvo card, about 58% are doing so without any issues, but 22% have indicated driver resistance as the most common problem experienced. The issue of driver resistance has resulted in extensive damage control on the ground, numerous consultations with the operator and numerous iterations of training and support

for the drivers. The future expansion of the system to service the IRPTN should be designed to remove driver intervention on the bus completely.

5.2.2 Lost cards

At this stage if a commuter loses their card they lose their money as the ability to "hot-list" lost cards is not yet available due to challenges relating to operating in an offline mode on board the bus. In addition, the requirement for interoperability between participating banks still needs to be addressed. Almex are currently exploring various options to provide a solution.

5.3 Revenue collection

Fare evasion continues to be an issue as commuters retain the option to pay for single fares in cash on board the bus and some commuters travel further than the transit product purchased allows them to (called overriding). Strategies that will assist in minimising the incidents of fare evasion will need to be factored into the development of business rules, fare structures and system architecture for the full roll-out of the EFMS to support the city's IRPTN. For example, a flat fare structure within zones as opposed to stage-based fare structures could avoid overriding. The full transition from cash to the Muvo card is expected to evolve over time, with the ultimate aim to have the majority of the transport payment transactions card-based.

5.4 Acceptance by the operators

The bus operators managing the city's public transport services have embraced the Muvo card and are looking forward to enhanced revenue once the roll-out is complete, due to the incidents of fraud currently experienced with the paper coupons. The operators are already benefitting from improved management information enabling the operators to better plan and manage the service.

The ETA is in the process of working with one of the taxi associations on potentially rolling out the Muvo card system to the taxis operating within the eThekwini region. In addition, other municipalities have expressed interest in piggy-backing the Muvo infrastructure onto their existing public transport operations.

ETA is working on developing an operating model to best service the needs of these entities.

5.5 Future plans

Once the paper coupons have been discontinued and the uptake of the card is optimised, opportunities to increase commuter convenience and enhance their overall experience with the Muvo card will be explored, including the introduction of more outlets where cards can be procured and loaded, the introduction of self-service options such as vending machines and Automated Teller Machines (ATM's) for topping up cards. Standard Bank is also exploring a pilot of Near Field Communication (NFC) enabled phones as a card replacement option. The city will also explore the feasibility of running loyalty programmes for commuters to further enhance revenue collection.

6 CONCLUSION

The successful implementation of Muvo card for the City of Durban has been a key milestone towards the roll-out of the city's fully-integrated public transport network. It will provide the public with a single payment method across multiple modes of transport as well as other goods and services, making their travel experience more convenient. The system will also benefit public transport operators and the ETA through improved revenue management and the provision of management information, allowing public transport services to be better planned and organised to meet, and even exceed, the expectations of the communities they serve.

7 LIST OF ABBREVIATIONS AND ACRONYMS

ABBREVIATION	DESCRIPTION
AFC	Automated fare collection
EFMS	Electronic fare management system
EMV	Europay MasterCard Visa
ETA	eThekwini Transport Authority
GPRS	General packet radio service
GPS	Global positioning system
IRPTN	Integrated public transport network
ITS	Intelligent transportation systems
NDoT	National Department of Transport
NFC	Near Field Communication
NIV	Network Integration Validation
NLTA	National Land Transport Act
Optima	Open platform ticketing machine
OTI	On Track Innovations
PASA	Payment association of South Africa
SAM	Security access module
TIP	Terminal Integration Process

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