



# **Account Linked Payment Service Concept White Paper**

**Final Draft Version 1.0**

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## DOCUMENT HISTORY

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## 1.0 DOCUMENT OBJECTIVES AND INTRODUCTION

Transit system operators around the world are implementing contactless smart cards as their primary fare payment medium for their automatic fare collection (AFC) systems in order to facilitate interagency fare payments and to provide the many conveniences made possible by this technology. In the vast majority of regional systems, fare payments are facilitated by the introduction of a prepaid stored value program which is operated and maintained by the transit agencies or a third party organization which operates a regional clearing house (RCH). While this approach has become the default model for the public transit industry, a new payment concept has been introduced that may create a new paradigm for fare collection that offers the potential for dramatic reductions in infrastructure and operational costs while also attaining even higher levels of patron convenience. This concept is known as the account linked payment service (ALPS).

This document is intended to provide the reader with a description of the ALPS concept, the basic options for its implementation and the benefits and risks that should be weighed when considering its use within an agency-specific or regional fare payments program. The reader should bear in mind that this document does not define specific methods for implementation as such decisions will be unique to each geographic area and must be made with consideration to the needs, requirements and operating conditions of the region where such a program is to be offered.

## 2.0 CONCEPT OVERVIEW AND EXECUTIVE SUMMARY

The ALPS concept leverages the existing open bankcard (credit and debit card) payments networks to facilitate fare payments and to eliminate many of the costs and responsibilities typically associated with a transit stored value program. In its most basic form, an ALPS system offers the ability to assess single ride fare payments directly against a bankcard account, enabling the patron to utilize this familiar payment vehicle to fund their fare payments while deferring actual transfer of funds to a later date. Although there are several variations on this approach, the basic premise used in the development of this document is that all ALPS systems will utilize a higher level of centralized processing of fare payments as opposed to the typical stored value systems which rely heavily on fare processing logic at the point of sale (e.g. bus farebox, validator or faregate). By shifting a significant percentage of processing to a centralized facility, ALPS programs can offer even greater levels of patron convenience while minimizing and, in some cases, eliminating certain operational functions common to most stored value programs. ALPS-based sys-

tems may also accommodate a nearly unlimited variety of prepaid regional and agency-specific fare products as well as transit benefits and “fairest fare” services where final calculation of the cost of transit system use is determined based on monthly (or some other time period’s) activity.

Transit agencies participating in an ALPS program must accept a greater amount of payment risk than that associated with prepaid stored value programs and must be willing to transfer many operational and program marketing responsibilities that have traditionally been performed by the agency. In turn, bankcard issuers must accept responsibility for leveraging their existing infrastructure to perform those operational functions. In each case, the rewards for accepting change are significant but require a shift in mindset from the “norm” and adoption of a new paradigm in order to enjoy those rewards.

### **3.0 RESEARCH EFFORTS**

Development of this document was performed on a voluntary basis by members of the APTA Fare Systems and Program Committee, Technologies Subcommittee. Information included in this document is based on knowledge obtained through experience with the development, implementation and/or evaluation of ALPS programs as well as from research conducted on one or more of the three known ALPS implementations referenced in this document. Although efforts have been made to verify the accuracy of the information included herein, limitations on time and resources make it impossible to guarantee accuracy in all instances. Readers of this document should be aware of this point and should also recognize that this document offers opinions and suppositions from its authors. Specific sources of information quoted or referenced in this document have been identified and should be independently evaluated by any organization considering implementation of an ALPS system.

### **4.0 IMPLEMENTATION OPTIONS AND PLATFORMS**

An ALPS-based system accepts contactless smart cards or other radio identification tokens (“fare payment media” – FPM) and, rather than debiting a stored value purse on the payment medium, transfers each fare transaction to a central computer system for processing and settlement. Three variations of platforms for the support of an ALPS program are considered in this document:

- The Transit Value Account (TVA) Platform, in which the agency issues cards linked to a transit stored value account recorded within a central computer, while offering automatic replenishment of the account from a bankcards designated by the patron
- Direct Bankcard Charge (DBC) Platform, in which bankcards are enabled for use in the transit system and single fare payments as well as purchases of discounted fare products are charged against the bankcard account.
- Indirect Bankcard Charge (IBC) Platform, in which the agency issues the payment medium but each card or token is linked to a bankcard and single fare payments as well as purchases of discounted fare products are charged against the bankcard account.

Although each variation has advantages and disadvantages, many of the operational and infrastructure components are identical as noted below.

#### **4.1 Fare Payment Media**

Access to the transit system and calculation of the corresponding fare can be facilitated using two different forms of FPM: 1) Identity Tokens and, 2) Smart Devices. Although the base technology for each type of media is the same (some form factor such as a plastic card or

key fob with an embedded computer chip and an attached antenna to enable radio frequency communications with the fare payment device), the amount and type of data stored on the media and the manner in which it is used varies significantly.

#### 4.1.1 Identity Tokens

This mode uses a smart card or similar device which has a unique electronic serial number which is used to uniquely identify the token within the system and to link the token to its associated Transit Value Account (TVA). The information stored in the token is static and may be limited to the serial number only or may also include additional data such as a rider class and/or expiration date. When presented, the fare payment device confirms the validity of the token by checking either a positive or negative list of payment tokens. Calculation of the fare payment amount and determination if any discount or related services should be applied is performed by the Central System where the TVA is maintained. Since data on the FPM cannot be updated or supplemented with additional data, certain functions that are normally performed at the transit point of sale (such as the application of transfer rules associated with rides on two or more systems within a set period of time) must be conducted by the Central System.

##### 4.1.1.1 *Benefits*

The use of Identity Tokens within an ALPS system minimizes the complexity and logic required at each of the fare payment devices. Since no transit-specific data need be recorded on the card or updated by the AFC system, the agency/region is not obligated to deploy significant numbers of devices with contactless smart card readers and could generally limit contactless interactions with the card to faregates, fareboxes and validators. The issuance process is also simplified since the FPM will not be required to be initialized with a transit application and customer data (for transit system use) will not need to be encoded.

##### 4.1.1.2 *Disadvantages*

The use of Identity Tokens may limit the flexibility of the system to support complex fare products (e.g.: Multi-leg journeys) and transfers which could be accommodated at the Central System but would be hampered by inherent timing delays since all fare transactions relevant to fare calculation would have to be received by the Central System before final fare processing could be completed. For bus systems, this detriment could be a particular concern since fare transaction data may be delayed by one or more business days, requiring the Central System to suspend fare processing for that period of time. In addition, in some instances, such as the prevention of multiple uses of the FPM in a short period of time – “passback” – is no longer possible or is technically infeasible. Accordingly, alternative mechanisms must be created at the Central System to mitigate the increased risks associated with the loss of this functionality at the point of sale.

#### 4.1.2 Smart Devices

In this mode the payment media is an intelligent device such as a smart card which can securely store transit-specific data about the cardholder and past and current fare-related transaction information that can be used to perform fare calculation. As an example, a Smart Device might hold the information about the last several fare payments in order to allow the system to determine if a discounted transfer fare can be applied. The fare payment device utilizes and updates transit data stored on the card in order to determine the fare for the current ride and then sends the transaction to the central systems to be posted (debited) against the TVA. The central system will also perform additional calculations and fare payment in order to apply discounted fare products and transit benefits to the fare payment and, when appropriate,

to replenish the TVA balance with funds secured from a linked bankcard account designated by the cardholder. With this approach, the fare payment device will not only read data stored on the Smart Device but will also change and add data as needed for fare calculation and record keeping. Unlike traditional stored value based systems, however, the Smart Device will not (as a general rule) store fare products which are validated and/or updated at the point of sale.

When the Smart Device mode is applied, the agency/region must assume responsibility for defining the specifications for the encoding of transit-specific data on to the FPM and monitoring adherence to those specifications when third parties are allowed to issue the media to patrons, as is the case with a DBC implementation.

#### 4.1.2.1 *Benefits*

One of the main benefits of the Smart Device approach is that transaction data may be written to the card, read and recorded by FPMs and passed on to the central system for comparison with the transaction database. This information can be used to identify and reconstruct lost transactions, a phenomenon which can occur when, for example, a faregate system is disabled and/or power is lost before its store of fare payment transactions is transmitted for settlement. In addition, the presence of transit specific data on the card which can be updated each time the card is used supports offline validation of fare payment via mobile devices that cannot be continuously connected to a host system. This benefit is particularly important for ungated systems that rely on on-board conductors and fare inspectors to confirm that a patron has paid the required fare.

Data stored on the card can also be used to provide patrons with the ability to review recent transaction records at vending equipment or kiosks and that data can be used to support more complex fare products such as multi-journey passes and multi-point (e.g. Point A to Point C via Point B) fares.

Real-time fraud evasion support functions are another form of benefit offered by the Smart Device implementation method. Using the date, time, cumulative amount and/or cumulative number of fare payment transactions stored on the card, the FPM logic can be programmed to block additional uses within a set period of time. This technique, commonly known as anti-passback provides the means to limit excessive use of a stolen card. Such measures are difficult to implement and generally infeasible without the capability to read and update data stored on the card. Additionally, FPM logic can temporarily or permanently block use of the card (for any reason) by setting a particular data element on the card. This capability enables the AFC system to eliminate records from the card negative list and thereby reduces the size of that file. In turn, the communications bandwidth required to distribute the negative list to all FPMs and the negative list storage requirements for each FPM are proportionately reduced.

#### 4.1.2.2 *Disadvantages*

Reading and writing transaction data stored on the card will add time for each fare transaction and, in order to offer an appropriate level of security for card updating, requires the use of more expensive fare media. This approach may not be acceptable to traditional bankcard issuers due to concerns that the fixed payment data stored on the card could become corrupted or its security might be compromised by allowing access to other portions of the card memory. Since the storage and security of data on the card must be standardized in order to support system to system interoperability, all agencies participating in a regional system us-

ing the Smart Device approach must agree on a standard data architecture and a common set of rules for recording data within that architecture<sup>1</sup>. In addition, the agency and/or region must define a mechanism to monitor and police compliance with that standard and those rules in particular if third party issuers (an important aspect of many ALPS platforms) are allowed to introduce cards for use in the system(s). These responsibilities will add capital and operational costs for the agency/region.

#### 4.2 **Card Issuance**

In a TVA or IBC implementation the FPM is issued by the transit agencies, regional system operator or by another entity working under contract for the regional program. Although the program can be structured for third parties (such as financial institutions or membership organizations) to issue the media, there are minimal benefits and significant costs and responsibilities accrued to the issuer. Accordingly, voluntary (uncompensated) support by third parties is unlikely. In any case, a comprehensive distribution network with appropriate security protections for unissued stock must be established and serviced by the agency/region and must include a program for procurement and initialization of FPM as well as replacement of expired or failed FPM.

In a DBC implementation, the fare medium is a traditional bankcard which can be used at any designated retail location but which has also been enabled for use in the transit system. Accordingly, the media must be issued and serviced by financial institutions.

#### 4.3 **Fare Payment Devices**

The hardware configuration for an ALPS program is nearly identical to that used in a standard stored value scheme. Each fare payment device is configured with a contactless reader that is capable of securely interacting with the FPM. Each device must be connected (either through a wired or wireless local area network or similar mechanism) to the Agency Central Computer (ACC) to facilitate two way communications. The hardware configuration for a train or subway station may also include communication routers and/or a station computer/server and bus systems may utilize a depot computer as an intermediary between the bus payment system and the ACC.

One critical difference in the field hardware configuration is the use of ticket vending machines (TVMs) which are typically used as the primary means for patrons to load stored value or fare products to their FPM. With the DBC and IBC implementation methods, no stored value is ever created and, therefore, the program does not require use of TVMs. While TVMs may still be needed to dispense, as an example, magnetic tickets for one-time users of the transit system, patrons with an ALPS-enabled fare medium need not use these devices. Although the TVA-type implementation of ALPS uses a form of stored value, funds are not en-

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<sup>1</sup> APTA is currently sponsoring an effort to create a national standard for smart card-based AFC systems. This effort, known as the Universal Transit Farecard Standards (UTFS) Task Force includes specifications for an object-based data architecture. For additional information about the UTFS effort, refer to:

[http://www.apta.com/about/committees/UTFS/task\\_force\\_meeting\\_minutes\\_050224.cfm](http://www.apta.com/about/committees/UTFS/task_force_meeting_minutes_050224.cfm)

coded on the FPM and, therefore, TVMs are not required to add funds to the TVA. In all cases, the agency/region may wish to utilize TVMs for other purposes within an ALPS-based program (such as to display recent fare payments recorded by the central system) but as a general rule, ALPS program are not burdened with the costs associated with procurement, maintenance and servicing of this type of equipment.

#### 4.4 **Central System**

The Central System (either an ACC or RCH) is designed to handle the bulk of the fare processing functions. This system receives individual transactions from each of the fare payment devices in order to perform fare calculation, apply discounted fare products and/or transit benefits and (for the TVA platform only) to deduct fare payments from the TVA. The Central System must maintain a database of all valid FPM, all fare payment transactions performed with each payment device, a negative (or positive) list of FPM, and links to discounted fare products and transit benefits. The Central System may also need to provide patron access to TVA-based transaction information either through periodic statements or via Web-enabled or telephone-enabled systems and must support interactive communications and file sharing with all participating agency systems, transit benefit providers and a bankcard payment acquirer or bankcard network.

#### 4.5 **System Security**

Implementation of an ALPS-based program does not have a direct impact on system security, thus the security scheme can be designed in generally the same manner as that applied to a standard stored value-based system. In most systems using smart cards or similarly capable FPM, the card must be authenticated by the associated reader before any additional fare processing functions can be performed. Although various techniques can be applied, authentication normally requires the card to generate (or store) an authentication value which has been calculated using a secret key, unique data from the card (such as its electronic serial number) and an algorithm. The reader extracts the unique data from the card's chip and then uses its copy of the secret key to calculate the authentication value and to compare it to the value generated by or stored in the card.

In a stored value program, backend processes are usually applied to confirm that the dollar value of fare payments made against the stored value account do not exceed the amount added to that account and also to identify and flag transaction anomalies (e.g., two different fare payments being made with the same card at the same time in two different locations). This form of security provides the means to detect problems after the patron has used transit services but before a widespread breach of system security has occurred. This form of security can also be applied to a TVA platform but is replaced with alternative security mechanisms in an IBC or DBC platform. In IBC and DBC platforms, security at the fare payment device and the Central System will typically consist of "velocity checks". Velocity Checks involve tracking the number of times a particular card is used to perform a fare payment transaction in a predetermined period of time. Using velocity checks, the Central System can readily identify a card that has "excessive" transaction activity and flag that card for follow-up review or addition of the card record to the system's negative list. Bankcard issuers will also have fraud identification tools and applications that can also be employed, if desired, to transit fare payments assessed against the bankcard account.

In the IBC and DBC platforms, actual remittance of funds for fare payments occurs one to three business days after the patron has used the transit services. During that time and for several weeks thereafter, the transaction may be disputed by the cardholder, resulting in a potential loss of revenue for the agency/region. Retail merchants mitigate this risk by obtain-

ing an online authorization from their bankcard payment acquirer at the time that payment is being made for goods or services. Even the most sophisticated acquirer systems, however, cannot provide an authorization within the timeframe (approximately 250 milliseconds) normally required to support efficient throughput at a fare payment device. As a result, the agency / region must absorb some additional payment risk although this risk can be mitigated through velocity checks and other functions as briefly described above.

Will all three implementation platforms, a negative list of FPM is stored within each fare payment device and updated regularly to prevent the continued use of a specific card/media in the event the system fails to collect funds for a fare payment performed using that card/media. It is also possible for these platforms to maintain a positive list of FPM, however, even the most modern AFC systems lack sufficient internal memory to support more than a few hundred thousand records.

Unlike prepaid stored value systems, the financial impact associated with the loss of transaction data could be significant since individual fare payments that are lost before receipt by the Central System could result in a direct loss of revenue. The impacts may be greater with an Identity Token system where transaction history information cannot be stored on the card. Accordingly, an agency/region considering the implementation of an ALPS program should ensure that appropriate measures are taken to minimize the opportunity for loss of data and to provide the means to efficiently and expeditiously detect and recover lost data.

#### 4.6 System Architecture

In all cases, each fare payment acceptance device must be electronically connected to the central system in order to send transactions and receive updates to the regionally managed negative list of cards. Figure 4.0 illustrates a typical system architecture and the flow of fare payment transaction data through that architecture.

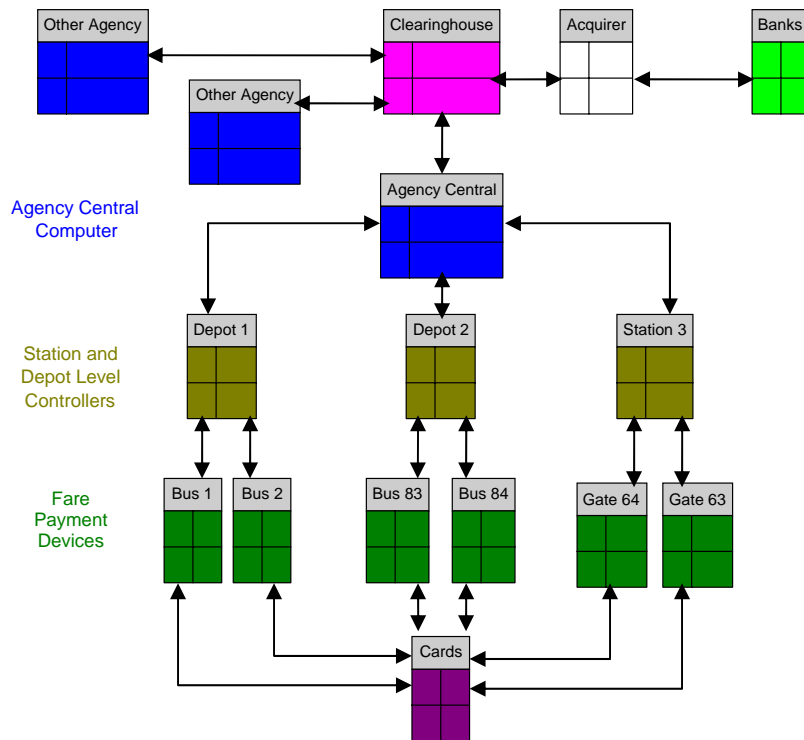


Figure 4.0 Typical System Architecture

#### 4.7 Negative Impacts and Other Concerns

Agencies and regions considering the implementation of an ALPS program should also evaluate the negative impacts on existing operations and systems. Of these impacts the most obvious (for DBC and IBC-based platforms) is the inherent loss of float on stored-value funds since no stored value is created. This impact is somewhat negated by the fact that discounted products can still be sold and managed centrally, however, the percentage of use of discounted products versus the convenient single fare payments that require no advance purchase has yet to be determined. The relatively rapid pace of funds remittance (usually 1-2 business days) from bankcard acquirers will also help to minimize this impact. Regardless, organizations that elect to implement an ALPS program should recognize that the collection of revenues will be altered and, therefore, may require adjustments to the current revenue management model.

Since all three ALPS platforms described in this document require negotiation and integration with a bankcard payment acquirer, it is essential for the agency/region to properly assess its bankcard payment processing needs and to establish an acquirer relationship that properly addresses those needs. While there are numerous bankcard payment acquirers to choose from, careful evaluation of the acquirer's capabilities, willingness to properly support the ALPS platform selected by the agency/region and having the technical wherewithal to fulfill the obligations of efficiently processing ALPS transactions are critical to program success. Likewise, the acquirer must provide these services at a reasonable cost since the ultimate goal of any ALPS program will be to migrate the vast majority of patrons away from other forms of payment and to bankcard-based fare payments.

Note: The Visa and MasterCard *bankcard associations'* primary responsibility is to represent the banks that issue Visa and MasterCard accounts. These associations develop and manage the *association rules* which dictate things such as transaction specifications and procedures for settling disputes. The use of these established rules for the processing of transit payments present significant advantages, but these rules also limit a single agency's control on policy. In addition the associations and debit card networks (the organizations that facilitate merchant acceptance of branded debit cards) define the "interchange" compensation rates for issuers – the fees paid by the merchant (indirectly) to the issuer each time the issuer's card is used to make a purchase from the merchant.

"Riding the rails" of the existing open payment networks enables agencies the ability to outsource a costly facet of their infrastructure while receiving daily automated reconciliation with prompt funds availability. However, this requires that as a registered merchant accepting bank issued cards, the association rules of transaction processing and settlement must be followed.

The bankcard associations and their issuing members along with the debit card networks continue to increase their focus on markets that are based on the processing of micro-payments (generally considered to be payments under \$5 although no industry-wide definition for this term exists). In recent months the association and some network rules have been amended to address pricing and procedural issues that encourage the use of bankcards in low-ticket industries such as fast food, parking, and movie theaters. Though major progress has been made, the rules have not yet addressed the unique pricing and procedural requirements that have made this type of solution prohibitive for transit. However, with the growing interest in contactless payment technologies from both issuers and consumers, the bankcard industry is working to develop solutions that can support the requirements of transit agencies and their riders while providing profitable opportunities for bankcard issuers.

For all ALPS platforms, the availability of a comprehensive negative (or positive) list of cards stored within each fare payment device and updated regularly by the Central System is an essential element for the reduction of risks and mitigation of fare evasion and fraud. In particular, since the IBC and DBC platforms are designed to collect funds after the patron has used the transit services, the risk of non-payment is considerable if those platforms are supported by a robust program for negative (or positive) list management and distribution. Accordingly, the agencies participating in ALPS programs should design their fare payment devices/systems with sufficient storage capacity for extensive negative/positive lists and should implement mechanism to actively update those lists as problem cards are identified by the agency, region, acquirer or issuer.

#### 4.7.1 Fare Payment Services for The Unbanked

Although the vast majority (over 85%)<sup>2</sup> of the ridership of a typical transit system carries at least one bankcard product (a requirement for the DBC and IBC implementation platforms) a fraction of the transit population will fall into an income group that cannot qualify for a bank relationship or may chose to avoid such relationships despite having the necessary income and credit. This group, referenced as the “Unbanked” within this document, must also be provided fare payment services in an ALPS-based program. There are various solutions for this concern including:

- Retaining or establishing a magnetic ticket or cash-based system for fare payments. This solution has the disadvantage that it requires procurement, maintenance and servicing of magnetic stripe equipment including ticket transports or swipe readers or currency/coin handlers at each device. Since this equipment will only be used by a minority of the riding public, the cost per ride/patron will be inordinately high for each device although the total capital and operating expense will be considerably lower than that associated with a traditional AFC system based exclusively on magnetic tickets or cash fare payments. Agencies/regions with existing magnetic ticket programs may find this solution to be the most attractive since the program will already be bearing the costs and should see a significant reduction as the ALPS program expands.

Note: The use of magnetic tickets in any fare collection system has inherent security concerns that must be addressed by the agency/region. Depending on the nature of the security program, additional costs may be incurred.

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<sup>2</sup> According to surveys conducted by the Federal Deposit Insurance Corporation, the Federal Reserve and numerous private organizations, less than 15% of the nation’s households do not have a checking account and less than 10% have no bank account of any kind. These and other surveys have confirmed that a growing percentage of the unbanked adult population are turning to alternative forms of financial card products (such as payroll cards, prepaid debit cards, etc.) in order to have payment capabilities similar to traditional bankcard holders. Surveys by transit agencies, such as those conducted by the Chicago Transit Authority (CTA) and Port Authority Trans-Hudson (PATH) offer additional data to support this statement. Both the PATH and CTA surveys indicate that the percentage of low income (annual household income below \$25,000) riders is nearly identical to the percentage of the overall population in that economic group as reported in the US Census data and other US Government surveys . The CTA survey also confirmed that more than half of their low income patrons carry a bankcard and regularly use automated teller machines.

- Implementing a traditional host-based or card-based stored value program in conjunction with the ALPS system. This approach leverages the contactless fare payment equipment already in place for the ALPS program but adds incremental costs for card issuance, cardholder support and card reload services. This method has the advantage in that patrons have the means to use cash to purchase and reload their FPM and it eliminates the high maintenance costs typically associated with cash and magnetic ticket processing equipment at each fare process device while providing all patrons with access to use convenient, contactless FPM.
- Issuing low cost contactless smart cards (AKA Limited Use PICCs). This disposable form of contactless smart card is priced higher than magnetic tickets but does not require a reload infrastructure since the products are designed for one time use or use as a time based pass product for a limited duration. Although the agency/region must bear the cost of the payment media as well as the cost of a distribution network (usually a fleet of TVMs), this approach has the advantage of eliminating the high maintenance costs associated with cash and magnetic ticket processing equipment without the need to establish an extensive cardholder support organization.
- Retrofit of Existing Smart Card System  

Conversion of existing smart card-based AFC systems to support an implementation of an ALPS program is technically feasible and should offer significant cost benefits to the agency/region to consider such an approach. The specific nature of the system enhancements or replacements that will be required will vary depending on the system's current design and on the type of ALPS platform selected for implementation. According, agencies/region considering such an approach should first define the objectives for the program, select a particular type of ALPS platform and then identify and analyze the changes that will be required to support it. In all instances, a more robust set of services for the Central System is needed and will, accordingly, require enhancements at that level to accommodate this need.
- ALPS Program Benefits  

The introduction of contactless smart card technology as the payment medium for an automatic fare collection system offers a variety of benefits for the patron and for the agency or agencies that accept the media for fare payment. Since such benefits are generally associated with any transit smart card implementation, this document focuses exclusively on the incremental benefits linked to the specific application of the ALPS concept to an AFC program. Chief among these benefits is the potential for a reduction in program operations since the very nature of ALPS programs transfers substantive portions of operations to third parties (bankcard issuers and bankcard payment acquirers). Assuming that the agency/region is successful in negotiating cost effective fee rates from the acquirer and bankcard issuer(s), ALPS implementations also offer the possibility for significant cost reductions for those operations while also reducing the need for TVMs as well as the costs associated with procurement, maintenance and servicing of those devices. While some percentage of AFC operations must continue to be performed by the agency/region even in program with a preponderance of ALPS-based transactions, it is reasonable to expect reductions in operations and operational costs of up 75%<sup>3</sup> for ALPS programs using a DBC platform and 25 to 50%<sup>1</sup> reduc-

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<sup>3</sup> The percentages used in this paragraph are estimates only and are derived from the elimination and/or reduction of smart card program management and operations functions listed in Table 4.0. Quantification of specific financial benefits for any agency/region requires analysis of existing (or

tions for IBC and TVA-type implementations as illustrated in Table 4.0. In addition, the use of a Central System application to manage the use of discounted fare products and transit benefits greatly simplifies the introduction of new or modified products since those changes need only be made and tested on one software program and can potentially be implemented without the need to load or test new software to each fare processing device, assuming no device software modifications are required. Likewise, the increased use of centralized processing of fare transactions can more readily support the introduction of loyalty programs where free rides or other fare discounts are offered for regular usage of the AFC system. A centralized system can easily determine when a patron has achieved the required level of system usage and can apply the appropriate discount without requiring direct interaction with or encoding of loyalty program specific data on the card and/or the introduction of a loyalty application at each fare processing device.

Table 4.0 Operational Function Responsibilities

Operational Function	Bankcard Issuer	Bankcard Payment Acquirer	Retained or shared by Agency / Region
Develops & implements marketing solicitations / programs	DBC		DBC IBC TVA
Orders & maintains FPM inventory	DBC		IBC TVA
Manage FPM replacement	DBC		IBC TVA
Perform FPM distribution	DBC		IBC TVA
Manage FPM initialization & processing	DBC		IBC TVA
Provides 1 <sup>st</sup> tier cardholder support	DBC IBC		IBC TVA
Issue periodic statement to patron	DBC IBC		TVA
Manage FPM bulk order sales, packaging, & fulfillment			IBC TVA
Manage patron billing & collections	DBC IBC		TVA
Provide customer access to account and transaction data	DBC IBC		IBC TVA
Perform funds reconciliation and settlement		DBC IBC TVA	DBC IBC TVA
Establish, maintain and service reload			TVA

planned) costs for these functions and determination as to the amount of reductions that can be achieved, dependent on the specific method of implementation selected.

Operational Function	Bankcard Issuer	Bankcard Payment Acquirer	Retained or shared by Agency / Region
network including TVMs			
Submit negative/positive FMP list updates	DBC IBC TVA	DBC IBC TVA	IBC TVA

Note: Benefits for patrons and other participants in an ALPS program vary depending on the type of platform implemented. These benefits are discussed in detail in Sections 4.1 – 4.3 below.

#### 4.8 Transit Value Account

The Transit Value Account (TVA) option is very similar to and utilizes all of the features and functions of a traditional stored value system but transfers the bulk of transaction processing and stored value account management to the Central System. In particular, the stored value balance and individual fare products are not recorded within the card memory but are instead housed in a central repository of transit rider information linked together in a patron account (the TVA). This centrally maintained TVA then forms the backbone of all fare collection operations. Access to the funds and fare products within the TVA is facilitated via the FPM that can be used throughout the transit network for system access. Funds can be added to the TVA through a variety of different mechanisms (such as deposits made through TVMS or at ticket booths) but the primary means is an automated service that accesses funds in a linked bankcard account to replenish the TVA stored value or discounted fare product at predetermined time intervals, when the stored value balance is depleted or when the discounted fare product expires or is used in its entirety.

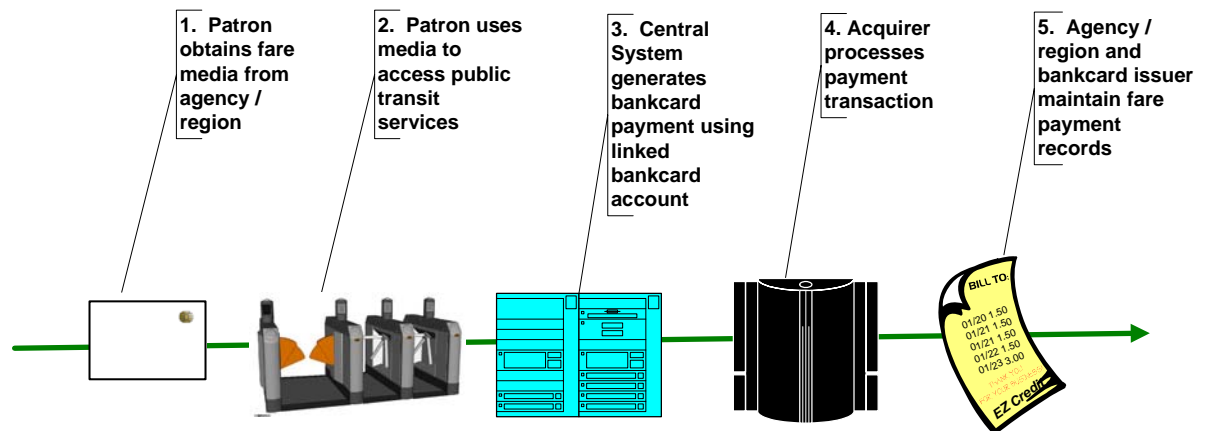


Figure 4.1 TVA Transaction Flow

##### 4.8.1 Benefits

Since the TVA approach largely mimics the functions and features of a traditional pre-paid stored value program, the benefits for the patron are the same with the exception that the addition of fare value to the TVA from a remote location (e.g.: By phone or through the Internet)

can be made instantaneously while the traditional program may require several hours or a few days to deliver the added value through downloads to each fare processing device. In addition to those patron benefits, a subset of the operations reductions associated with other ALPS platform types will apply to the TVA solution as indicated in Table 4.0 above.

#### 4.8.2 Disadvantages

Because of its similarities, the TVA platform is burdened with many of the same disadvantages and costs of a traditional stored value system. As an example, the agency/Region must still assume responsibility for creation and management of the TVA's and must provide the means for patrons to access TVA transaction history. While such functions could be outsourced to a third party organization, it is highly likely that outside organizations will require substantial compensation for such services since those responsibilities will entail significant operational resources while providing little or no benefit to the vendor. The most significant disadvantage for the TVA platform is that the majority of costs typically associated with a stored value system are retained by the agency/Region with no opportunity to transfer those costs to another party as is possible with the IBC and, particularly, with the DBC implementation methods.

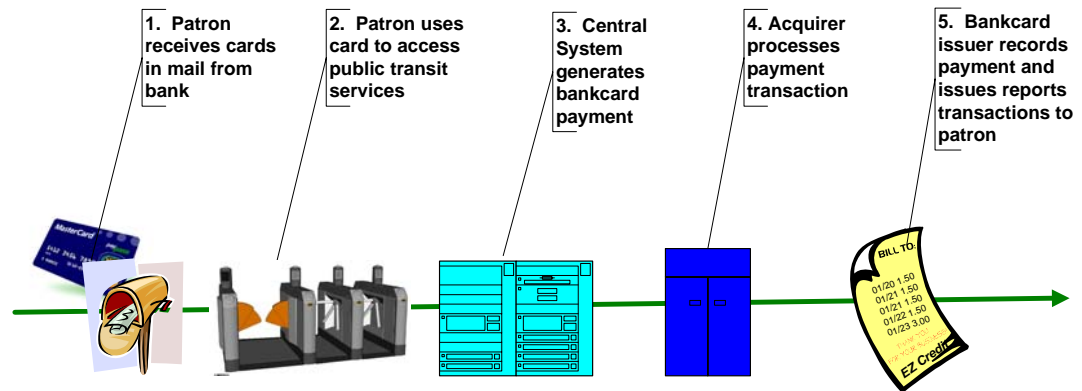
#### 4.9 **Direct Bankcard Charge**

In the Direct Bankcard Charge (DBC) platform the payment media is a bankcard (credit or debit card) issued by a financial institution for use at designated retail merchant locations and enabled for use in the transit system. As is normal for most bankcard products, the patron must complete an application which must be approved by the financial institution and a relationship or "account" must be established for the patron.

Note: If a patron has already been issued a contactless bankcard (still a relatively rare situation in the US), it may be possible to add the transit specific data to the existing card (where necessary) or to simply add the card record to the Central System database in order to enable the card to be used in an ALPS DBC platform.

In consequence, patrons go to the bankcard issuer rather than to the agency/region for primary customer support issues. The transit agency/region becomes a merchant in the open bankcard payments network, relying on the system integrator(s) and bankcard payment acquirer to act in concert to enable acceptance of contactless credit and debit cards.

With a DBC platform, individual fare payments are routed from the fare payment devices (after basic fare calculations have been performed) to the Central System which, after completing the fare calculation process and applying discounted fare products and transit benefits as appropriate, forwards the transaction on to the bankcard payment acquirer. As with any retail merchant purchase, the amount of the transaction is assessed against the patron's bankcard account and will appear on the monthly statement provided by the bankcard issuer. Although the Central System must maintain a record of each bankcard that has been registered for use within the program, the primary source of transaction data is maintained by the bankcard issuer along with the data from other payment transactions performed with the bankcard.



#### 4.9.1 FPM and Application Specifications

While any bankcard with radio frequency-based functions can be integrated with the system, the agency/region must specify the distinct card features (minimum memory size, frequency, reading speed, microprocessor, etc.) that are required for FPM used within the system. Accordingly, the agency/region must assume responsibility for policing the introduction of new cards into the system and maintaining a database of all cards that are: A) Used in the system (in order to facilitate cardholder support), B) Linked to a discounted fare product or transit benefit: or, C) Are included in the negative list. It may also be appropriate to maintain a list of 100% of the cards that are eligible for use in the system in order to facilitate fraud analysis and/or support maintenance of a comprehensive fare payment transaction database. If transit specific data is stored on the cards, the agency/region must also define the rules for the location, structure and security of that data in order to ensure that the information is properly protected and accessible via standardized methods.

#### 4.9.2 Direct Bankcard Charge Using Identity Tokens

In 2005, bankcard issuers in the US announced the broad roll out of contactless bankcard programs after piloting the technology in 2003 and 2004. These programs, sponsored at the national level by MasterCard (program name: PayPass), American Express (program name: ExpressPay) and Visa (program name: n/a) are being implemented by large financial institutions that have indicated that card issuance will be in the millions. These issuers and national sponsors have also announced that several large national retail chains such as CVS pharmacies, 7Eleven convenience stores Ritz camera stores and Regal Theaters (among others) will convert their payment systems to accept the new cards as well as traditional (magnetically striped) bankcards. Although the use of this type of contactless card has not been tested in the US, the radio frequency technology applied to the cards is compliant with the ISO/IEC 14443 standard, the same standard used for contactless smart cards used in mass transit systems. Accordingly, it may be possible for ALPS-based systems to accept the new contactless bankcards for fare payment. As with other Identity Token systems, transactions performed with these contactless bankcards do not utilize any transit-specific data stored on the card and, therefore, data on the card cannot be changed or supplemented with additional data when presented to a transit fare payment device. Accordingly, ALPS systems that accept contactless bankcards must perform all but the most basic fare payment calculations at the Central System.

The acceptance of contactless bankcards offers distinct advantages for interregional fare payments since the calculation of fares is generally very simple and straightforward for this type of transaction. Accordingly, contactless bankcards issued outside of the agency/region's market can still be accepted and fare payment processing is limited to assessment of a full

fare against the bankcard account. This approach has the advantage, however, that it is unnecessary to maintain a central database of all FPMs that are eligible for use in the system. Since each contactless bankcard stores the necessary account data to formulate a payment transaction, the system can capture the required information from the card and use it to process a normal fare payment. Only cards linked to discounted fare products and/or transit benefits would then need to be recorded in the Central System database.

Note: For the past decade, bankcard payment programs at retail merchants have required the merchant to obtain the patron's signature and an electronic payment authorization at the time the purchase of goods or services was consummated in order to minimize the risk of a returned/disputed payment. Since the contactless bankcard programs have been designed primarily to service the fast food, convenience store and similar high transaction volume merchants, the requirement for the patron's signature and an online authorization has largely been waived for payments below \$25. Likewise, merchants are not obligated to provide a receipt to the patron for these transactions. These three rules changes are beneficial to transit programs where it would be infeasible to adhere to the old set of rules.

By leveraging the financial services industry's roll out of contactless bankcards maximize, transit agencies/regions may be able to benefit from the number of participating card issuers and speed roll out of their ALPS programs. This model is not without its difficulties, however, and careful consideration / evaluation is required to ensure that the approach is suitable to the business, security and technological requirements of the agency/region before it is adopted.

#### 4.9.3 Card Issuers

In the DBC model, the bankcard issuers must accept the following responsibilities:

- Issue credit or debit cards containing smart chips to their customers who request them
- Provide a card issuance list to the Central System
- Market the card product(s) to consumers
- Receive fare payment transactions from the acquirer and process them in a manner similar to that applied to other retail payments
- Remit funds for bankcard payments to the agency/region
- Submit negative list updates to the Central System
- Issue monthly statements to card customers and/or provide electronic access to all fare payment transaction data
- Provide primary customer service by fielding customers' complaints and questions about their use of the cards

For convenience and to provide better participation incentives to bankcard issuers, the agency/region may elect to begin operations with only one or two bankcard issuers. In this way, the acquirer, the issuer(s) can secure a competitive advantage by operating for a period of time before other issuers are allowed to participate. As the system matures, many issuers could take part or the agency/region may wish to periodically auction the exclusive issuance rights for some predetermined number of years.

#### 4.9.4 Benefits For Patrons

For patrons participating in an ALPS program using a DBC platform can receive the following benefits not available from traditional stored value fare payment programs:

- Cards offer guaranteed security against theft and fraudulent use
- Post payment for fares (for credit card users)

- Ability to earn rewards for card use (for bankcard programs that offer such rewards)
- Passengers can have a single payment product for transit and retail purchases
- Ability to use a familiar payment product provided by a trusted financial service provider

#### 4.9.5 Bankcard Issuer Benefits

Because of the important role played by the bankcard issuer in an ALPS DBC platform, it is essential that the benefits for the issuer be substantial, quantifiable and reasonably assured with participation. The benefits most important to the bankcard issuer that can be offered by a DBC platform include:

- **Top of Wallet Status:** This phrase is generally used to refer to the cardholder's perspective that a particular bankcard is his/her most important payment product and, therefore, is used more often than any other payment product in his/her possession. By enabling a traditional bankcard to be a commuter's access to the mass transit system, it is reasonable to expect that that card will achieve Top of Wallet status for the patron since it will become the one payment tool that he/she must carry each and every business day.
- **Lift in Transit System Use:** The term lift is typically used to refer to an increase in some aspect of desirable customer behavior. Since stored value fare payment programs must, by necessity, offer a variety of payment options for patrons to purchase stored value, only a portion of purchases are performed with a bankcard with the rest facilitated by cash, checks and other forms of payment. Using the DBC platform, all ALPS-based fare payments are linked to a bankcard purchase, thereby increasing the number and dollar volume of bankcard transactions.
- **Lift in Non-transit Use:** Even without Top of Wallet status, bankcards used in the DBC platform will be carried on a daily basis by commuters and other frequent transit riders. This "must carry" requirement will generate increased usage for purchases at other, non-transit merchant locations. While even a small percentage of increase would be beneficial for the bankcard issuer, at least one ALPS program using a DBC platform has recorded increases of up to 40%.
- **Lift in Solicitation Acceptance:** The typical adult in the US receives numerous offers from financial institutions each month touting a pre-approved credit card or loan with nothing more than a signature required to accept the offer. Despite the relative ease of obtaining these products, the average consumer will reject up to 99 offers before giving serious consideration to and accepting a solicitation. In recent years, less than 1 solicitation in 100 resulted in a new bankcard being issued. With the introduction of an attractive feature (use for convenient, hassle-free payment of transit fares) that is meaningful to a large percentage of credit-worthy patrons, an ALPS program using a DBC platform has the potential to positively impact solicitation acceptance rates and to make a particular offer stand out among the many competing products. Since major product campaigns often include millions of solicitations, even a small increase in acceptance rates can generate hundreds of new bankcard accounts and associated fees and interest for an issuer.
- **Improved Cardholder Loyalty:** Numerous studies within the financial services industry have confirmed that the cost of acquiring a new customer is dramatically higher than the cost of keeping an existing client and the rewards for retaining customers are also more attractive. By adding an ALPS feature to an existing bankcard product, the issuer can substantially improve cardholder loyalty by elevating that card to Top of Wallet or at least "must carry" status for the cardholder. Assuming that the DBC platform implementation is executed properly, the cardholder should immediately recognize the convenience and benefits offered by his/her ALPS card and will be reluctant to switch to a competitor's product unless a comparable ALPS feature is also offered.
- **Access to New Cardholders:** All bankcard issuers are interested in acquiring new cardholders – either from the unbanked segment or by targeting customers of a competing is-

suer. The DBC platform may offer opportunities for both pursuits depending on the fare payment solution offered to the unbanked and the type and quality of information available for patrons that are likely to participate in an ALPS program. If issuance of bankcards for use in the agency/regional program is restricted to a small number of issuers (for some predetermined amount of time), early issuer participants will have an ideal opportunity to target marketing towards the commuting public, many of which will be unbanked or will be using the competitor's products.

#### 4.10 Indirect Bankcard Charge

An Indirect Bankcard Charge system combines the use of an agency/region issued Identity Token that is secured by a bank issued credit or off-line debit account (Visa, MasterCard, American Express, Discover, Diner's Club, JCB). The payment token generally consists of a low cost device with limited, read-only memory and processing capabilities.

Once the token is presented to the fare payment device, a unique identification (UID) number stored permanently in the token's electronic memory is checked against a negative or positive list of tokens. Once the UID has been verified, the fare payment device is activated, allowing the patron to enter the transit system. Fare is calculated at a later point, converted into a bankcard payment transaction and then tied to a bankcard account which has been pre-registered at the Central System by the patron. The bankcard payment transaction is sent for authorization to the issuer through a traditional bankcard processor.

This "indirect" solution requires the majority of the same infrastructure and operational support needed for the TVA platform since the procurement, initialization, sales and distribution of tokens remains the responsibility of the agency/region. Unlike the TVA platform, however, no stored value is used thus the agency/region does not need to establish a reload network although TVMs or similar devices may be needed to support token distribution. The primary difference is that the "indirect" solution moves the responsibility of financial reconciliation to the issuing banks and third party processors. The cost savings associated with the outsourcing of this function depends heavily on the scale and efficiency of the existing solution.

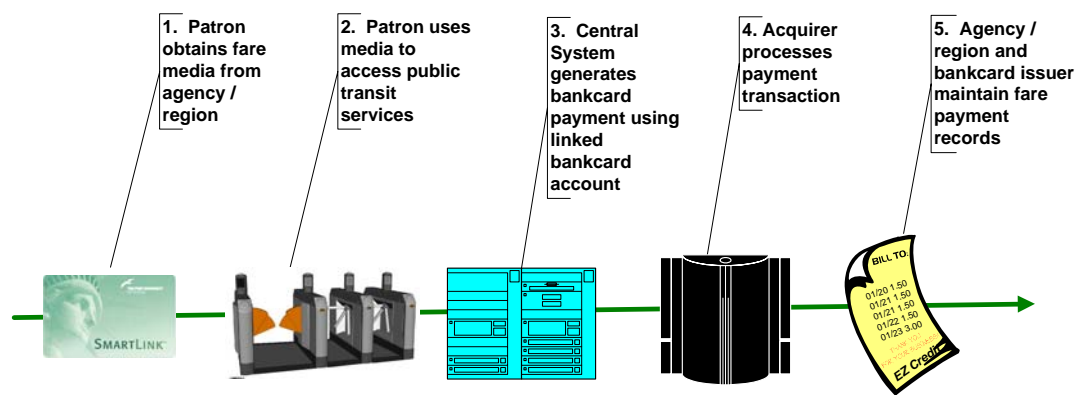


Figure 4.3 IBC Transaction Flow

##### 4.10.1 Benefits

The IBC platform enables the patron to utilize any qualified bankcard to make fare payments. As with the DBC platform, IBC patrons will be able to obtain their individual fare payments details from their bankcard issuer and, if a credit card is used, will be able to defer payment to a later date. Likewise, the agency/Region will be able to offer a wide variety of convenient mechanisms for the patron to purchase discounted fare products and the patron will not be reliant on the availability of the agency/Region's vending equipment to facilitate those pur-

chases. As illustrated in Table 4.0, some of the operational functions required of a traditional stored value program can be reduced or eliminated with the implementation of a TVA platform.

#### 4.10.2 Disadvantages

The IBC platform is similar in many ways to the DBC approach with the key difference that the FPM is not a traditional bankcard and, therefore, is not issued by a financial institution. This difference maintains the responsibility of FPM issuance with the agency/Region and, accordingly, the associated costs and operational functions. The agency/Region must also provide a solution for the security of the bankcard information (which must be linked to the FPM record stored at the Central System) which is acceptable to and compliant with the security requirements of the Financial Services community. These stringent requirements were designed to protect the confidentiality and the security of bankcard and bankcard holder data in order to prevent the fraudulent use of that data. Compliance must be formally confirmed through one or more extensive security audits. In some instances, bankcard issuers may not accept the notion of bankcard data storage within the agency/Region's Central System, thereby requiring development and maintenance of a software application to perform a cross-reference from the FPM serial number to the bankcard number on behalf of all or each issuer. While this application would not be the responsibility of the agency/Region, the cost of its development and maintenance may be since it would serve primarily or even exclusively serve the needs of the agency/Region's fare collection program. Overall, only a portion of the operational functions listed in Table 4.0 can be transferred to another party and accordingly, the IBC implementation approach does not provide the most robust opportunity for cost reductions or avoidance.

## 5.0 CURRENT IMPLEMENTATIONS

Following are descriptions of three ALPS implementations. The examples chosen for use in this document detail program in Seoul, South Korea; Chicago, Illinois and the Kansai Region of Japan.

### 5.1 **Seoul, South Korea**

Seoul is the third largest transit system in the world after Moscow and Tokyo. It boasts the largest smart card system in the world with the longest operating history, and the first large scale deferred-payment transit system in the world.

Radio Frequency (RF) transit smart cards were first adopted in Seoul in 1996. At that time, 1 kilobyte MIFARE cards from Philips were used. System hardware was either purchased by the transit agencies or financed by the integrator receiving a percentage of fares collected for a set period.

In order to enable the transit fare structure, transfers, discounts, and other special transit charges, Seoul's credit cards have a special transit application (which stores transit-specific data) encoded on the card's computer chips along with a credit card application.

During the two years from 1996 to 1998, RF readers were installed on all gates. The system went fully operational in May, 1998, using a stored value program. In November, 1998, the system was upgraded to accept smart credit cards. Initially only one bank issued credit cards, and acceptance was slow. After seven other banks began issuing cards, the system reached greater penetration. From 2000, the systems shared a SAM (security access module) which allowed subway cards to be used on buses and vice versa.

**Devices in the Seoul Transit System** (April, 2003)

	Quantity	Bus	Subway
Contactless Readers	25,219	18,447	6,772
Charging Machines	4,719	4,078	473
Reader Data Management System	596	203	260
Center Management System	4	2	2
Supplier		C&C / Intek	C&C

5.1.1 History

The original idea of using smart cards for transit payment in Seoul was put forward in 1993 by Mr. Young-sam Jun, then CEO of C&C Enterprise Co. He was introduced to an official at Kookmin Credit Card Co., and the two of them approached the transit system officials jointly. Jun knew that any automated system could provide fare structure flexibility for discounted fares, distance computations, monthly passes, and would be faster than tokens.

Jun searched for a company to make smart cards in the shape of credit cards but in 1993, he was told it was impossible. Finally, he settled on batteryless MIFARE read/write chips with unalterable, unique serial numbers. Jun patented the use of a negative list check to authorize credit card acceptance at transit gates.

The partners came up with the idea of financing the deal out of future rider fees, which was ultimately accepted by the government. The deal states that a percentage of fees is paid until the cost of the installation is paid back. They spent several years promoting this idea among the government, banks and the public.

5.1.2 Fare Card Types

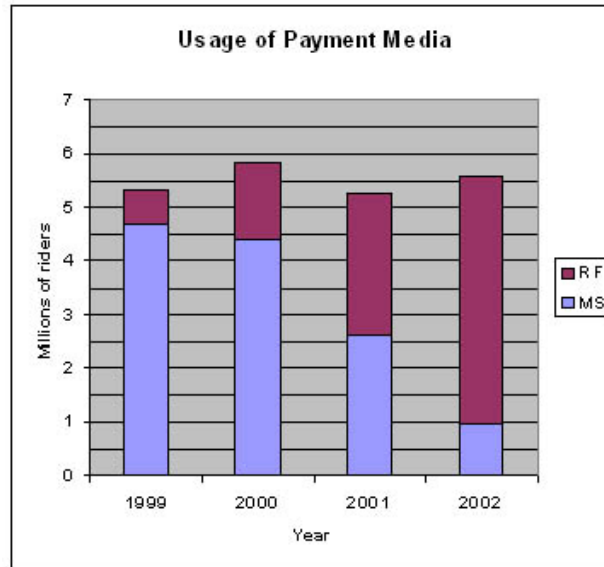


Stored value cards Issued and operated by the Seoul City Bus Transport Union, they are recharged at vending machines. There is no protection for fraudulent use of a lost card.



Transit contactless credit cards Fare payments are deferred and billed through monthly statements; no recharging is needed. Initially issued solely by Kookmin Credit Card, since February 2000, seven credit card issuers have joined the network to bring the total number of transit credit card issuers to eight.

### 5.1.3 Rollout



As the following chart shows, RF cards have rapidly replaced magnetic stripe cards in Seoul.

#### 5.1.3.1 *City Buses*

- February 1996: Pilot operation began
- July 1996: System completely live on all city buses
- February 1996: Stored value contactless RF Transit Cards adopted
- June 2000: Transit credit cards adopted for use

#### 5.1.3.2 *Subways*

- February 1998: Transit credit cards first adopted for pilot operation
- June 1998: System completely live on subway lines 1-4
- February 1999: Transit credit cards adopted for full operation on lines 5-8
- January 2000: Stored value cards adopted to provide fare collection for the un-banked.

#### 5.1.3.3 *Village Buses*

- November 2000: Pilot operation of both stored value and transit credit cards began.
- May 2001: Full implementation

#### 5.1.3.4 *Airport Buses*

- July 2001: Services began with both transit credit card and stored value cards.

### 5.1.4 Marketing: Discounted Fares When Using RF Transit Cards

#### 5.1.4.1 *Adults*

- City bus, village bus, subway: 8% discount off of full fare
- Airport Limousine bus: 5-10% discount off the full fare

5.1.4.2 *Students*

- City bus: 32% discount off of full fare
- Village bus: 23% discount
- Subway: 20% discount

5.1.4.3 *Discounted Transfer between Transportation Modes*

- Discounted transfers began July, 2001 on City buses and October, 2001 on subways and April, 2002 on village buses.
- Discounted transfer is applied only to stored value and transit credit cards.
- An adult transferring within 1 hour to a different transportation mode gets an additional 7% discount. Usage information (station, time, etc...) are recorded on the chip so if the transfer is made within 1 hour, the discount is automatically applied.
- Students already get a substantial discount so no transfer discount is offered to students.
- All discounts for using RF transit cards are borne by the city of Seoul.

5.1.4.4 *Interoperability with Other RF Transit Cards*

- January 2000: Stored value cards accepted on subways. (Only transit credit cards were accepted on subways prior to this date.)
- June 2000: Transit credit cards accepted on all city buses. Complete interoperability established between city buses and subways using both transit credit cards and stored value cards.
- November 2000: Village buses accept both transit credit cards and stored value cards.
- July 2001: Airport limousine buses accept both transit credit cards and stored value cards.

5.1.4.5 *Regional Interoperability of RF Transit Cards*

- June 1998: All Seoul subways and trains adopted transit credit cards.
- April 2000: Incheon subway lines adopted both transit credit cards and stored value cards of Seoul.
- June 2003: Greater Seoul (Seoul, Incheon, and Kyung-gi province) suburban bus operators upgrading their existing fare collection systems to adopt transit credit cards for their fare collection.

5.1.5 The Financial Industry's Participation

The following chart shows that bank credit and debit cards accounted for 36.3% of the total fare collection in June 2003.

**Seoul Mass Transit Usage Statistics**

	Rides	RF Transit Card			Other: Bus: Cash Subway: M/S Ticket
		Subtotal	Stored Value Card	Transit Credit Card	
Total	12,619,465 (100%)	8,629,553 (68.4%)	4,053,936 (32.1%)	4,575,617 <b>(36.3%)</b>	3,989,912 (31.6%)
Subway	6,576,361 (100%)	3,859,003 (58.7%)	1,452,531	2,406,472	2,717,358 (41.3%)
Bus	6,043,104 (100%)	4,770,550 (78.9%)	2,601,405	2,169,145	1,272,554 (21.1%)

The main profit centers for banks are that the transit card becomes the holder's primary card, the transit function is "sticky," as with mileage cards, and banks found that transit cards are often used for retail services near the stations. The acquirer today processes over \$1.5 billion annually in transit fares.

5.1.6 The Situation in Mid-2003

- 21,200,000 credit cards in operation
- RF transit cards used as student IDs and employee IDs. Transit watches sold and other applications being created.

**Seoul Mass Transit Daily Ridership as of April, 2003 (People/Day)**

SMSC Seoul Metropolitan Subway Corporation  
SRTC Seoul Metropolitan Rapid Transit Corporation  
KNR Korean National Railway  
IRTC Incheon Metropolitan Rapid Transit Corporation

	Rides	RF Transit Card			Other: Bus: Cash Subway: M/S Ticket
		Subtotal	Stored Value Card	Transit Credit Card	
<b>Total</b>	<b>12,619,465</b> (100%)	<b>8,629,553</b> (68.4%)	<b>4,053,936</b> (32.1%)	<b>4,575,617</b> (36.3%)	<b>3,989,912</b> (31.6%)
<b>Subway Total</b>	<b>6,576,361</b> (100%)	<b>3,859,003</b> (58.7%)	<b>1,452,531</b> (22.1%)	<b>2,406,472</b> (36.6%)	<b>2,717,358</b> (41.3%)
SMSC	2,992,923 (45.5%)	1,944,067	743,026	1,201,041	1,048,856
SRTC	1,685,231 (25.6%)	1,069,783	433,550	636,233	615,448
KNR	1,691,242 (25.7%)	788,197	266,353	521,884	903,005
IRTC	206,965 (3.2%)	56,916	9,602	47,314	150,049
<b>Bus Total</b>	<b>6,043,104</b> (100%)	<b>4,770,550</b> (78.9%)	<b>2,601,405</b> (43.3%)	<b>2,169,145</b> (35.9%)	<b>1,272,554</b> (21.1%)
<b>Seoul</b>					
General Bus	5,297,517	4,106,843	2,160,619	1,946,224	1,190,674
Small town Bus	4,301,787	3,306,222	1,728,609	1,577,613	995,565
Bus	995,730	800,621	432,010	368,611	195,109
<b>Kyonggi province</b>					
Intercity Bus	703,091	661,459	440,286	221,173	41,632
Intercity Bus	702,760	661,427	440,278	221,149	41,333
Airport Bus	331	32	8	24	299
<b>Incheon City</b>					
Intercity Bus	42,496	2,248	500	1,748	40,248
Intercity Bus	39,021	-	-	-	39,021
Airport Bus	3,475	2,248	500	1,748	1,227

**Subways as of June, 2003**

Agency	SMSC	SRTC	KNR	IRTC
Stations	115	146	107	22
Ticket Booths	202	180	129	24
Gates	2,587	2,141	1,662	382
System Integrator	C&C Enterprise		Daewoo / C&C	
Processing Company	Kookmin Credit Card, Ace Information & Communication			
Maintenance	In-house	In-house	C&C	In-house
Acceptance	<b>Seoul SV Card</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>

Agency	SMSC	SRTC	KNR	IRTC
Kyung-Gi SV Card	No	No	No	No
Incheon SV Card	No	No	No	No
<b>Transit Credit Card</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>

**Buses as of June, 2003**

Region	Seoul		Kyung-gi	Incheon
Transit Operator	Seoul City Bus Union	Seoul Village Bus Union	Kyung-gi Bus Union	Incheon Bus Union
No of Companies	58	144	45	25
No. of Buses	8,201	1,451	7,134	1,661
System Integrator	Intek	KEBT	Intek	Intek
Processing Company	Ace	KEBT		Ace
Maintenance	Intek	KEBT / Intek	Intek	Intek
Acceptance	<b>Seoul SV Card</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>
	Kyung-Gi SV Card	Yes	Yes	Yes
	Incheon SV Card	Yes	Yes	Yes
	<b>Transit Credit Card</b>	<b>Yes</b>	<b>Yes</b>	<b>Yes</b>

**Taxis as of June, 2003**

	Seoul	Kyung-gi	Incheon
Vehicles	70,000	28,407	12,530
Private	46,870	18,432	7,171
Corporate	23,130	9,975	5,359
Companies	258	196	61

**RF Transit Cards in Circulation as of April, 2003 (Units: ,000)**

	Total	Seoul	Kyung-gi	Incheon
Total	40,400	39,020	770	610
<b>Stored Value Card</b>	<b>19,280</b>	<b>17,900</b>	<b>770</b>	<b>610</b>
- Adult (Regular fare) Card	11,670	10,380	770	520
- Student Card	2,630	2,540	-	90
- Alliance Card	4,980	4,980	-	-
<b>Transit Credit Card</b>	<b>21,120</b>	<b>21,120</b>	-	-
- Kookmin Credit Card	9,000	9,000	-	-
- Samsung Credit Card	3,600	3,600	-	-
- BC Card	3,430	3,430	-	-
- LG Card	3,430	3,430	-	-
- WaeHwan Bank Card	710	710	-	-
- Hanmi Bank Credit Card	350	350	-	-
- Hana Bank Credit Card	220	220	-	-
- ShinHan Bank Card	380	380	-	-

5.1.7 The Situation Today

In July 2004, a new gate and farebox system was installed which accepts credit and debit cards as well as all of the 8 e-purses currently in use in Korea. It covers the entire Greater Seoul area, including airport buses and taxis. While it had problems in its inception, it now operates reliably.

Because Koreans under 18 find it impossible to get credit cards and because debit cards are not in widespread use in Korea, the number of stored-value cards remains high. Nevertheless, credit card market share has increased over the stored-value cards since 2003 and current estimates are that 30,000,000 credit cards account for 6,500,000 transactions per day.

The number of contactless credit cards is higher than Seoul's population because many people carry several.

Note: The average Korean holds 4.6 credit/debit cards while the average American holds 7.3.

More recent statistics are difficult to obtain but the general situation is as follows:

- Credit card use has expanded to over 50% penetration, 6.5 million rides per day.
- Approximately 30 million credit cards are in use.
- Additional uses besides transit include taxis, entertainment tickets, pay phones, vending machines, tolls, tax payments, building access, and many others.



- Since June 2002, parking meters have also accepted credit cards.
- In May 2002, transit credit card mobile phones went in pilot operation. They are in full use today.

## 5.2 Chicago, IL

The City of Chicago and its forty surrounding suburbs are served by bus and rail rapid transit service operated by the Chicago Transit Authority (CTA). The larger metropolitan area is also served by the Pace Suburban bus line and Metra, a commuter rail line provide access to the central city from many suburban communities. Riders may pay for full fare trips on CTA buses and trains, as well as Pace buses, using either of two smart card options. Smart cards cannot currently be used to pay reduced fares for seniors, customers with disabilities, or students. CTA offers magnetic media reduced fare permits that allow these customers to travel at less than full fare.

The first of the smart card options, the *Chicago Card*, is a contactless stored value smart card that was introduced in November 2002. The *Chicago Card's* stored value is debited on a pay-per-ride basis and may be recharged at vending machines located in each CTA rail station. Balance protection, which allows the user to recover the unused balance on a card at the time a card is reported lost, damaged, or stolen, is available to registered users. Replacement cards can be picked up from CTA Customer Service or received by mail; there is a \$5 fee for replacement of a lost or stolen card.

The second option is *Chicago Card Plus*, also a contactless smart card that was introduced in January 2004. Unlike *Chicago Card*, *Plus* cards do not hold stored value but, instead, are linked to a Transit Value Account maintained in a separate database. The *Chicago Card Plus* represents a major advance over the *Chicago Card's* capabilities. Like *Chicago Card*, *Chicago Card Plus* allows riders to use CTA trains and buses and Pace buses on a pay-per-ride basis, but also provides a pass option with unlimited rides within thirty days from the date that the card is first activated. *Chicago Card Plus* also adds an automatic TVA reloading ca-

pability that allows customers to use their credit card to pay for a user-determined amount of additional TVA value each time the TVA balance falls below \$10. The \$10 threshold ensures that customers will have enough value in their TVA during the 24-hour period needed to process the credit card transaction.

Since April 2004, the *Chicago Card Plus* has also been available through CTA's Transit Benefit Program, an employer administered pre-tax payroll deduction program. Like *Chicago Card*, the *Chicago Card Plus* is protected against loss, damage, or theft. Account balances are frozen upon report of loss or theft, and customers pay only a \$5 fee for a replacement card that allows them to access their existing TVA balance.

There is an initial non-refundable \$5 card issue fee assessed to patrons to obtain the *Chicago Card* or the *Chicago Card Plus*. As an incentive, the *Chicago Card* and *Chicago Card Plus* issue fees were waived between January and March 2004 after which the fee was reinstated. The fee waiver, which was supplemented with increased advertising and the introduction of additional features available only to *Chicago Card Plus* patrons generated strong press coverage and customer interest, resulting in the number of smart cards in circulation increasing by nearly 300%, growing from approximately 26,000 to more than 102,000 by the end of April 2004. As of that date, *Chicago Card Plus* accounted for 45,000 of these cards, or nearly half of the total smart card population.

The *Chicago Card* and *Chicago Card Plus* also provide pass-back privileges for the pay-per-ride option, which allow up to seven customers to board the same bus or enter the same rail station using the same card (a feature also offered with CTA's stored value magnetically striped ticket). A full fare or transfer fee, as appropriate, is deducted from the *Chicago Card* stored value or from the *Chicago Card Plus* TVA for each rider. In rail stations, customers must touch the smart card to a card reader on the faregate to get through the turnstile before passing the card back to the next customer to use. On the bus, the same procedure is used, but the bus operator must press a button after each presentation of the card in order to allow the next patron to board. The *Chicago Card Plus* also allows 30-Day Pass users to bring up to six customers along. The first customer's fare is recorded as a ride under the 30-Day Pass, while all subsequent uses by additional patrons are assessed as pay-per-ride fares against the TVA. The *Chicago Card Plus* 30-Day Pass is the only CTA pass fare product to offer this form of "passback" use.

Both the *Chicago Card* and the *Chicago Card Plus* offer features to ensure that the user will not be stranded due to lack of funds. Patrons using a *Chicago Card* are allowed to use any bus or subway line one time provided that the stored value remaining on the card is greater than \$0. The full amount of the fare is deducted from the stored value balance, creating a negative balance that is repaid the next time that the card is reloaded at a vending machine. *Chicago Card Plus* TVAs are automatically reloaded once the cardholder's balance falls to \$10 or less or, for patrons that purchased a 30-day pass, on the twenty-seventh day of a thirty day cycle beginning on the date the pass was first used.

#### 5.2.1 Planning and Implementation Process

In August 2000, CTA conducted a six-month smart card pilot program to test the feasibility of the technology and to gauge customer acceptance. According to CTA President Frank Kruesi, the smart card was implemented to provide easier access, greater durability, reliability and flexibility in fare payment for CTA customers. All of CTA's existing magnetic stripe automated fare collection equipment, developed by Cubic, was equipped with card readers and touch pads at the time of purchase in 1997 as part of CTA's plan to move into contactless technology. The cost of this automated fare collection system was \$106 million. CTA's pilot involved the distribution of 3,500 cards at sixteen sites, including high volume rail stations. Customers were charged a \$5 replacement fee for lost smart cards during the pilot program,

but the remaining dollar value on the card was restored upon confirmation by CTA. The cards were valid for four years.

Surveys were conducted after four months (December 2000) with this group of riders. The results of the evaluation were positive. In August 2001, CTA signed another contract with Cubic for 300,000 cards over three years. Cards were subsequently purchased under this contract in three different orders. The contract was for slightly more than \$1.5 million, which is equivalent to just over \$5 per card, and included encoding and printing. All funding for the smart card project was in place at the time of project approval and initiation.

CTA launched the *Chicago Card* in fall 2002. In late November 2002, the *Chicago Card* could be purchased online or by filling out and mailing in a form obtained at train stations, on buses, and at other CTA locations. A small, on-system marketing effort supported the launch of Chicago Card and included several field sales days to raise awareness of the project. CTA originally planned to outsource the customer service, marketing and distribution operations, but decided against doing so after researching other transit agency experiences and assessing CTA's ability to handle the activities internally. CTA determined that it would be more efficient, cost effective, and flexible to handle the clearinghouse operations and settle revenue receipts in-house. CTA already had a system in place to settle revenues with the Pace bus system, and continuing these functions did not require many changes.

In February 2003, CTA began planning the *Chicago Card Plus* program as a means to provide additional features to meet customers' needs. The CTA had learned from customer research that customers' top priorities included the ability to reload a transit card using a credit card as well as to manage their account on the Internet. The *Chicago Card Plus* was designed to include these capabilities as well as to offer a more convenient service for participants in the Transit Benefit program, which offers customers the opportunity to pay for commuting costs with pre-tax payroll dollars through voluntary payroll deductions.

The *Chicago Card Plus* was launched in January 2004. Chicago transit riders now have the convenience of managing their TVA through the Internet. The CTA invested over one million dollars to build a new website and customer database to support the smart card programs. This new application makes it possible to track and manage both new and existing smart card accounts and to maintain other important data, such as "negative list" information about invalid, lost, or stolen cards, protecting both customers and the CTA against card misuse and fraud. The new application allows for the collection of individual ride and credit card transaction data, which is essential for managing the *Chicago Card Plus* program.

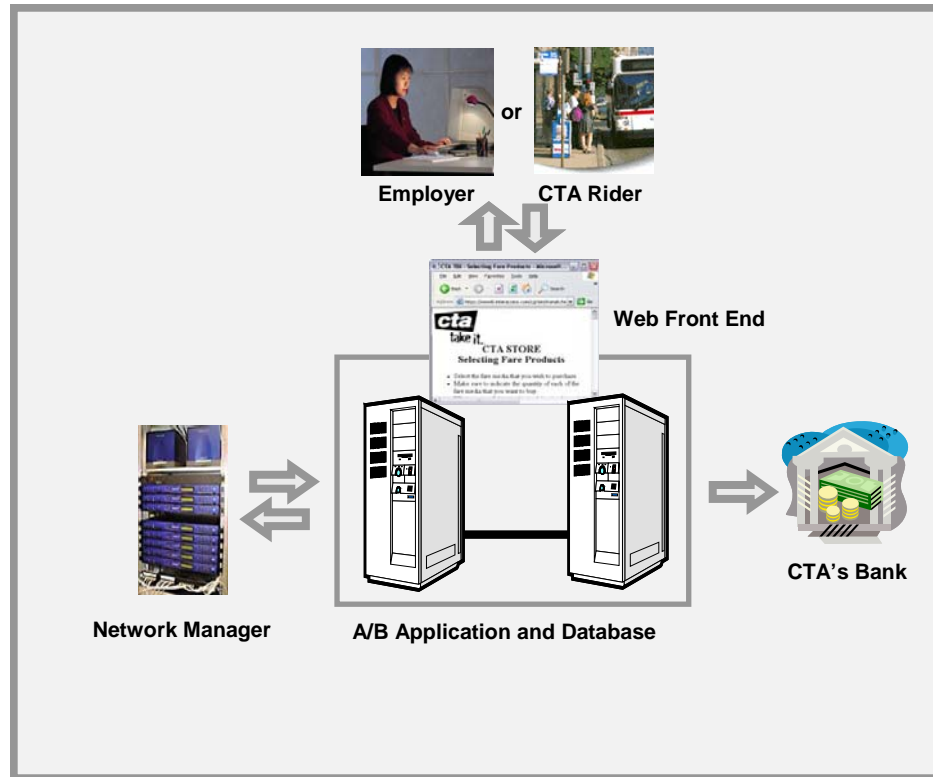


Figure 5.2 Chicago Card Plus System Architecture

Rather than outsourcing customer service, fulfillment, reporting and revenue clearing to a private contractor, as has been the case in some regional implementations of smart card-based fare programs, CTA continues to perform these functions internally. Transactions conducted through customer service websites account for the highest percentage of sales of *Chicago Card* and *Chicago Card Plus*. While other transit operators have issued more smart cards than CTA overall, CTA has one of the largest number of multimodal smart cards in circulation within a single US transit region.

### 5.2.2 Implementation Difficulties / Lessons Learned

One of the biggest challenges CTA faced was the need to provide systematic, clear, and concise customer information about the smart card programs to minimize customer confusion. Making customers aware of the existence of smart card programs requires different approaches from those needed to educate customers about specific program features. Transit agencies need to devote adequate time, funding, and expertise to addressing both aspects. One example of an information requirement was the need to explain to customers the differences between *Chicago Card* and *Chicago Card Plus* to enable them to choose the card appropriate for their needs.

Another hurdle CTA encountered was insufficient staffing to meet an aggressive smart card program implementation timeline. The program was launched before all the required departments and systems were fully prepared, putting an enormous strain on agency resources to make the system function smoothly for the public. Having a firm program launch date, however, helped get the program implemented sooner than if the launch date was less definitive.

### 5.2.3 Benefits Realized

CTA expects to reap cost savings from lower equipment maintenance costs as well as faster boarding times, which will improve on-time service delivery. CTA staff members anticipate that greater use of smart cards within the CTA system will lead to proportionally greater benefits.

### 5.2.4 Next Steps

CTA has not made any further plans with regard to the *Chicago Card* and *Chicago Card Plus*, but the agency continues to diligently monitor the effectiveness of its current programs. CTA is focused on building greater interest in the Transit Benefit program and increasing the distribution of the *Chicago Card* and *Chicago Card Plus* with the current functionality rather than adding other features to the cards at this time.

## 5.3 **Kansai Region, Japan**

In 2001, transit operators within the Kansai region of Japan (the second largest metropolitan area after Tokyo) formed the Surutto-Kansai Group to define, manage and operate a new fare payments scheme using a direct charge to a bankcard and checking account to post pay for transit fares. Fare payments are facilitated by a contactless smart bankcard which is issued by the Surutto-Kansai Group as well as two of its members. Since the payment media also serves as a general purpose credit (or debit) card, it can be used to pay for goods and services at over 300 retail merchants that have been signed up to accept the card. No other mean of fare payment is allowed on the transit systems in the region, making this the first 100% post pay fare program in the world. Since its initial launch in August 2004, the program (named "PiTiPa", an acronym for Postpay Integrated Circuit for Touch and Pay) over 80,000 cards have been issued. Over five million cards are expected to be issued and used in the PiTiPa system over the next five years as the program reaches maturity.

Cardholder spending is limited to 200,000 yen (approximately US\$2,000) each month, with only  $\frac{1}{4}$  of that amount allowed to be spent on non-transit purchases. The PiTiPa card uses Sony Felica technology, the same technology used in the successful stored value fare payment programs in Hong Kong, Singapore and other transit systems around the world.

The Surutto-Kansai Group justified the cost of the system enhancements for PiTiPa in order to eliminate the need for expensive ticket vending and stored value reloading equipment. In addition, the PiTiPa system provides the ability for select members of the group to implement loyalty program tied to card use which promote the non-transit services of the members. As one example, the Keihan group (one of the members of Surutto-Kansai) operates department store in addition to a major train line between the cities of Osaka and Kyoto. Patrons who use the train line and also shop at the department store on the same day receive 2% discounts for any purchases made with the PiTiPa card. Other Surotto-Kansai members have similarly diverse lines of business where the implementation of loyalty program might be used to generate additional revenue.

The PiTiPa system has been designed to be interoperable with the ICOCA system, a stored value program operated in the Kansai region by West Japan Railway. Unlike PiTiPa, patrons of the ICOCA system must load prepaid stored value on to their smart cards before using the transit system. The link between the two systems is expected to be activated in 2006.

## 6.0 CONCLUSIONS AND RECOMMENDATIONS

Without question contactless smart card technology represents one of if not the best fare mediums for transit agencies use due to the inherent reductions in equipment maintenance, increased equipment life and dramatic improvements in patron convenience made possible by this technology. Transit agencies and regions throughout North America and beyond that have elected to implement this technology with a stored value program have each had to establish new infrastructure and operations to support their program. Without exception, the cost of program implementation and operation has exceeded estimates and continues to be a significant impact on the finances of the agency/region. In the US, where fare collections cover an average of only 50% of the cost of operations, the incremental expenses of a stored value-based smart program can be an especially challenging issue. The ALPS concept may provide an ideal solution for this issue since it offers all of the benefits of contactless smart card technology combined with the potential for significantly lower infrastructure investment and operational cost.

At a minimum, all ALPS implementation platforms minimize the need for card reloading devices and provide a simpler means to introduce new or change the rules for processing existing fare products and services. Of the three systems, the DBC platform discussed in Section 4.2 offers the largest number of benefits and the best opportunity for cost avoidance (for new systems) and cost reductions for existing stored value-based programs. The key to success in each of these programs includes successful negotiation of fees with a bankcard payment acquirer and careful selection of an ALPS platform that is best suited to the agency's/region's needs and objectives for its smart card fare payments program.

## 7.0 APPENDICES

### 7.1 Related Terms, Abbreviations and Acronyms<sup>4</sup>

<b>Association</b>	Financial industry term generally used to refer to the Visa and MasterCard organizations which are comprised of a membership of bankcard issuers and bankcard payment transaction acquirers.
<b>AFC</b>	Automated Fare Collection
<b>ANSI</b>	American National Standards Institute
<b>Application</b>	Usually a computer program. In the transit case, data loaded into a smart card that interacts with the PCD/CID for the purpose mutual authentication, transaction record storage and fare calculation.
<b>CID</b>	Card Interface Device—a PCD combined with an intelligent device (such as a single board computer) in order to send, receive and process information from/to the card
<b>Collision</b>	When two or more cards are presented at a gate and the gate does not know which to charge
<b>CSR</b>	Customer Service Representative at a bank or transit agency

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<sup>4</sup> For a complete list of terms, abbreviations and acronyms used in this document, refer to the APTA Glossary, available on the APTA website.

<b>DBC</b>	Abbreviation used in this document for Direct Bank Charge
<b>Direct Bank Charge</b>	Term used in this document to refer to one of three types of processing platforms for an ALPS system.
<b>EEPROM</b>	Electronically Erasable Programmable Read Only Memory
<b>FPM</b>	<b>Fare Payment Media</b>
<b>IBC</b>	Abbreviation used in this document for Indirect Bank Charge
<b>INCITS</b>	International Committee for Information Technology Standards
<b>Indirect Bank Charge</b>	Term used in this document to refer to one of three types of processing platforms for an ALPS system.
<b>IEC</b>	International Electrotechnical Commission
<b>Interchange</b>	Term used in this document to refer to the fees paid by merchants to bankcard issuers when the issuer's card is accepted by the merchant for payment of goods or services.
<b>ISO</b>	International Standards Organization
<b>ISO 10373</b>	An international standard that defines testing methods for smart cards
<b>ISO 14443</b>	An international standard for contactless smart cards
<b>ISO 7810</b>	An international standard primarily associated with contact-based smart cards which defines, among other things, physical specifications
<b>LU PICC</b>	Limited Use Proximity Integrated Circuit Card. A type of contactless smart card designed for use over short periods of time (generally one month or less) and which is disposable and priced to be competitive with magnetic tickets.
<b>Negative list</b>	A list of bad card numbers used to prevent fraud in offline authorization of charges
<b>Offline</b>	Said of a PCD able to authorize charges by itself without querying a central computer, or said of a transaction authorized that way
<b>Online</b>	Said of a PCD able to authorize charges only by querying a central computer via a network, or said of a transaction authorized that way
<b>Passback</b>	The fraudulent practice of passing a stolen card back through the gate to the next rider
<b>PCD</b>	Proximity Coupling Device – a contactless smart card reader capable of communicating with a PICC without physical contact
<b>PICC</b>	Proximity Integrated Circuit Card
<b>PKI</b>	Public Key Infrastructure, an asymmetric cryptography technique. Ordinary symmetric key cryptography uses a single key for encryption and decryption, so both sides must have the secret key. Public key (asymmetric) cryptography uses a pair of keys where each key is a very long number that cannot be computed from the other. The private key is kept secret at the PICC manufacturer and the public key can be distributed to the PCDs.
<b>POS</b>	Point-of sale device, a device that originates charges, like those used in stores. A PCD that takes credit cards can be considered a POS device.

<b>RF</b>	Radio Frequency
<b>RFID</b>	Radio Frequency Identification, another word for contactless card technology
<b>SAM</b>	Security Access Module—a device which is used to securely store encryption keys
<b>Sticky</b>	Said of a bankcard that has a special feature like transit fare payment which makes the account harder for the customer to terminate
<b>Top-of-wallet</b>	The effect said of a bankcard that becomes the user’s primary card
<b>Transit Value Account</b>	Term used within this document to refer to host-based stored value.
<b>TVA</b>	Abbreviation used within this document to refer to a “transit value account”.
<b>Unbanked</b>	Term used to refer to individuals that do not have an account with a financial institution or “bank”.
<b>Velocity Check</b>	Term used to refer to methods used by AFC systems to restrict the maximum number of fare payments/transactions that can be performed with a single fare card during a set period of time.

## 7.2 Document Contributors

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