

**Smart Card
Alliance**

**Transit and Contactless Financial Payments:
New Opportunities for Collaboration and
Convergence**

A Smart Card Alliance Transportation Council White Paper

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About the Smart Card Alliance

The Smart Card Alliance is a not-for-profit, multi-industry association working to stimulate the understanding, adoption, use and widespread application of smart card technology. Through specific projects such as education programs, market research, advocacy, industry relations and open forums, the Alliance keeps its members connected to industry leaders and innovative thought. The Alliance is the single industry voice for smart cards, leading industry discussion on the impact and value of smart cards in the U.S. and Latin America. For more information please visit <http://www.smartcardalliance.org>.

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Executive Summary

Since the late 1990s, U.S. transit agencies have made significant investments in contactless smart card-based automatic fare collection (AFC) systems. Over the past few years, the financial industry has begun introducing new payment media based on contactless smart cards for use in the retail point of sale environment. Both of these industries have settled on the common ISO/IEC 14443 standard defining the card/reader interface, which provides the opportunity to establish links between the two industries.

The value proposition for the use of contactless smart cards in the mass transit marketplace has been well documented for more than 15 years. Many, if not most, transit agencies throughout the world have recognized this value and have either implemented or planned for implementation of a contactless smart card in their fare environments. These implementations have generally made use of agency-issued smart cards that are typically used in the closed transit systems only, or in some cases also used in retail locations that have been established as extensions of the closed transit systems. These are typically stored-product implementations where the card holds the fare product or cash value that is updated with each use of the card.

Recent developments in the mass transit and financial payments industries have created opportunities for convergence and collaboration. For example, the financial payments industry is focusing on expanding its share of the micropayments market and making the necessary changes in business rules and practices to foster that expansion. Some transit agencies, who are seeking further improvements in customer service and operating efficiencies, are looking beyond their successful fare collection systems toward reducing, though not eliminating entirely, their role as a payment media issuer and transaction acquirer and becoming more like a retail merchant in an open payment system. This notion overlaps a broader transit industry goal to facilitate regional travel through open, interoperable fare payment in a way that is both convenient for customers and efficient for transit agencies. While there are other implementation models, two of which are also described in this white paper, there is a specific focus in this paper on the acceptance of standard contactless financial payment devices directly at the customer's point of entry at fare gates, on buses or on any other mode of transportation.

Implementation considerations for this approach to transit fare payment center more on business and operations rather than on issues arising from technology definition, standards, and technical infrastructure. In the context of accepting traditional, unaltered financial payments solutions, the three key issues that emerge for transit agencies are transaction time, online authorization, and risk management.

In a manner similar to other merchants that accept financial payment products, transit agencies are now working with the financial industry and payment brands to develop the methods, business rules and risk models that address these issues and that enable acceptance of all financial industry-issued contactless payment devices. The definition of the risk model and business case for this acceptance approach – by the issuers, the transit agencies and the processors and acquirers that support them – will be one outcome of this collaboration. Toward this end, two pilot programs, one in New York and the other in Utah, are now underway.

This Smart Card Alliance Transportation Council white paper discusses these and related issues, as well as providing details about the way traditional financial payment products are used and about transit industry requirements for payment systems. The paper also describes the current fare collection environment associated with contactless smart card use in transit and presents the way contactless payment cards and devices are being used at the retail point of sale. The paper further examines the opportunities and challenges in using a card issued for use in retail payments within the transit fare collection environment and discusses whether these industries may be able to link payment products and services. Finally, this paper summarizes two pilot programs where financial industry-issued contactless payment devices are being used for paying transit fares.

1 Introduction

Both the public transit industry and the financial industry have demonstrated an ongoing interest in expanding the linkages between transit fare payment systems and financial payments. The Federal Transit Administration Guidelines, "Transit-Financial Model," published in 1999, explores the ramifications for both transit agencies and financial institutions of entering into a business arrangement associated with a smart card fare payment system. The Smart Card Alliance white paper, "Transit and Retail Payment: Opportunities for Collaboration and Convergence," published in 2003, explores various scenarios for implementing a combined transit and retail payment card, from use of a multi-technology card (with a contactless chip for transit payment and a traditional magnetic stripe for retail payment) to a multi-application contactless smart card (supporting both transit and retail payment).

Since the late 1990s, U.S. transit agencies have made significant investments in contactless smart card-based automatic fare collection (AFC) systems. Currently, projects are under way in major metropolitan areas in North America to deploy fully integrated contactless smart card-based transit fare systems. These systems use a contactless smart card as the fare medium. Financial credit, debit, and prepaid cards are often used to purchase dedicated fare media or reload or add value to a contactless fare card at a ticket vending machine, kiosk, web site, or other location. The transit contactless payment card is then used to pay the fare when boarding a bus or entering a gate.

Simultaneous with these developments in transit, the financial industry is introducing new payment media and is beginning to address the low value transaction (micropayments) market:

- The financial industry is now issuing contactless credit, debit and prepaid cards and other form factors such as fobs, targeting markets in which consumers typically use cash and where speed and convenience are critical. Over 13 million contactless financial payment devices have been issued in the United States, with over 32,000 retail locations accepting contactless payment as of mid-2006.
- American Express, MasterCard, and Visa have implemented new programs and rules for certain merchant categories which perform low value transactions; these programs and rules may also apply to contactless credit and debit transactions. The new programs make financial payment products¹ more attractive to consumers and merchants in markets that traditionally have used cash.
- New services and payment models, including aggregation of transactions and establishment of prepaid accounts, are being offered that may provide more cost-effective processing for low value transactions.

With these new developments, the question arises as to whether transit agencies and the financial industry can now develop stronger linkages between transit fare payment and financial payment systems.

The objective of this white paper is to discuss how the new financial industry directions could impact transit industry fare payment. The white paper is intended to provide a framework for discussion of the opportunities and challenges in linking transit and financial payment and to present options for how standard contactless financial payment devices can be used for transit fare payment. This white paper explores the following:

- Current transit payment systems and their unique requirements
- New financial industry products and services that target the micropayments market

¹ For the purposes of this white paper, the terms "financial payment product" and "financial payment device" are used to refer to credit, debit and prepaid cards, fobs and other form factors that are issued by the financial industry.

- Key considerations for implementing one model that allows transit agencies to accept American Express, MasterCard, and Visa contactless payment cards—as they are presently being issued in the U.S.—as another option for paying transit fares on a bus or at a gate, without the intermediate step of purchasing transit-specific fare media.
- Two pilot projects, MTA New York City Transit and Utah Transit Authority, which are evaluating the use of contactless financial payment devices to pay fares directly at subway gates and on buses, respectively.
- Possible alternative implementation models that could leverage the capabilities of multi-application smart cards and contactless payment-enabled mobile phones.

The transit and financial industries are breaking new ground in adopting new payment media and models. Various models could be implemented that would allow the transit and financial industries to leverage the new financial industry directions and both industries' choice of common contactless smart card technology for the payment device. Each model carries with it a specific business case with different cost/benefit characteristics. Transit agencies will need to develop requirements and model how different solutions can meet their specific business needs in order to select an implementation approach.

Both the transit and financial industries are currently very interested in understanding the opportunities and challenges of using contactless credit, debit and prepaid devices for transit fare payment. With such strong interest, it is expected that the current implementations will fuel discussion to evaluate how the two industries can work together to deploy solutions that deliver value to all participants in the transit payment process.

2 Transit Payments

The mass transit industry introduced electronic ticketing systems for automatic fare collection (AFC) throughout the 1970s and into the early 1980s. When these first-generation systems reached maturity in the late 1990s and early 2000s, the U.S. transit industry embarked on a massive infrastructure replacement cycle, resulting in the investment of over \$1 billion in new systems. These new systems incorporate the latest developments in information technology (IT) and use contactless smart cards as the primary fare medium.

State-of-the-art contactless smart card-based fare collection systems are either operational or currently being delivered in Washington, D.C.; Baltimore; San Francisco; Oakland; Los Angeles; Chicago; San Diego; Seattle; Minneapolis; Houston; Boston; Philadelphia; Atlanta; and the New York–New Jersey area. The system in Washington, D.C., is fully operational. Others are in advanced stages of delivery and are scheduled to be fully operational within the next 2 years, resulting in the issuance of an estimated 15 million contactless smart cards and installation of over 20,000 payment processing devices.

As part of these initiatives, multiple regional agencies are forging cooperative alliances and establishing regional administrative bodies to manage activities such as card distribution, customer service operations, transaction processing, and IT. For example, the SmarTrip™ system, which operates in the Washington, D.C.–Baltimore corridor, will include 17 independent transit operators, each with its own suite of products, discounting, and social equity programs.

Another important development is the movement by the transit industry to use the ISO/IEC 14443 international standard for the contactless smart fare card-to-reader interface and to define new transit-specific application-level and intersystem messaging standards. The American Public Transportation Association (APTA) is also defining the Contactless Fare Media System Standard to give transit agencies the opportunity to specify a regionally interoperable transit card as the basis for new procurements.

2.1 Transit Payment Mechanics

Transit fare payment systems rely on transit agency issuance of some form of fare media or ticket. The fare media in an AFC system is typically based on a stored value payment model. The stored value can be represented in different ways: as electronic cash, as a fixed number of rides, or as a period pass. Transit customers prepay a certain amount, which is then stored in an electronic purse (e-purse), either on the fare medium (e.g., a contactless smart card) or in a central account on a host system that communicates with the fare medium.

Credit, debit and prepaid payment products are widely accepted in the transit industry for purchasing fare media and for loading stored value on the transit payment cards. Transit patrons now use magnetic stripe financial payment cards to buy transit fare cards from vending machines, customer service agents, and transit web sites. Patrons are issued the transit-specific fare medium, which is then used for a fare payment transaction at the entrance to a subway, bus, or other mode of transportation.

Transit stored value instruments are typically valid for fare payment only at the agency issuing the fare media. There are emerging exceptions, as transit agencies pursue ways of facilitating regional travel by agreeing on a single standard payment media and service provider, or by promoting a single technical standard to which systems can be built.

In a fare payment transaction, the fare value is deducted at the point of entry from the stored value or validity is checked for a period pass. Transit e-purse transactions resemble typical cash transactions with two important differences:

- Communication between the local reader and the card at the point of entry completes the transaction. This interaction is generally both a validity check (through the application of rules that apply to the use of the fare media) and, in the case of stored value, an update

of the remaining value on the fare media. In some cases, the transaction occurs offline (e.g., on a bus) and a central system is updated later. In other cases, a virtually real-time data exchange is possible. In most cases, however, the transit system validates payment at the time of use of its fare media rather than accumulating charges and billing later. Systems like those in Washington, D.C. and New York City support a card-to-reader exchange and maintain a history of all fare transactions in an auditable database in a back-end system.

- During the transaction at the point of entry, data elements critical to the transaction (e.g., location identifiers, descriptions of past use) are transmitted to enable payment of the proper fare using applicable rules. To meet the operational requirements of most transit agencies, the transaction must be completed typically in less than 300 ms.

In a multi-operator system, clearing functions are either handled in a central system by one of the participating operators or by a third party. Transaction data is collected and reconciled at the central system, and the correct fare revenue is deposited in the appropriate operator's account.

2.2 Transit Payment Requirements

Transit AFC systems handle a number of functions, including issuing the payment instrument, applying agency-specific rules for determining the fare to be charged when the payment instrument is used, and processing the payment. Transit AFC systems have a number of critical requirements, including:

- Fast transaction speeds
- Transit fare policy support and pricing flexibility
- Data integrity and customer service
- Reduction in cash handling
- Data security and user privacy

2.2.1 Fast Transaction Speeds

One factor critical to a fare collection system is the speed at which the payment transaction takes place. Transaction speed has a significant impact on transit customer service, especially when crowded travel conditions occur. Shorter transaction times reduce the length of queues and speed passengers through the system. An electronic payment instrument must allow the customer to use the fare medium at a gate, perform the transaction, and open the gate in less than the unofficial industry standard of 300 ms. This speed is desirable for payment transactions on buses as well, since faster loading at bus stops reduces dwell times and, therefore, costs of operating the service route.

2.2.2 Transit Fare Policy Support and Pricing Flexibility

Transit customers must be charged the correct fare for the trip and they must also have the option of purchasing the type of fare that suits their current needs. Transit payment fare structures typically include fare policies and rules that are tailored to different rider populations, operating and financial constraints, and other factors. In general, transit fare policies typically include a single-ride, flat fare component and a distance or "zone-based" component. Systems may also offer a variety of unlimited use passes and discounts for individual fares purchased in advance or in bulk. Other factors can also influence fare pricing: when the fare is in effect (time of day), the specific route or direction on a route or line to which the fare applies, and even demographic characteristics of the individual who purchased the fare.

Pricing of fare instruments—whether single rides, passes, or bulk purchases—is subject to change on a regular basis. A transit fare payment system must therefore be able to update pricing globally for all instruments and also have the flexibility to introduce new fare instruments on relatively short notice.

Current fare payment systems and support operations provide customers with a number of ways to pay for fare media, including credit and debit card payment. In many cases, transit agencies also allow cash to be used to pay for single rides. As a means of adding value to fare media, some agencies have introduced account-based systems and, in at least one case (the ChicaGo Plus Card), a means of storing value in a central account that can be automatically replenished by linking the transit fare card to a credit or debit card. (Account-based systems are described in Section 4.1).

2.2.3 Data Integrity and Customer Service

Like all payment systems, transit-specific payment systems must ensure data integrity and provide easy and fast access to data to support customer service, either through in-house customer service agents or through direct access by the customer (e.g., a web site that allows customers to track transaction activity or reload value on a card). AFC systems also support risk management through such specific measures as velocity checks, hot-listing, and other fraud detection techniques and enable such techniques to be imposed by transit risk management staff.

2.2.4 Reduction in Cash Handling

Transit operators in general are interested in reducing the amount of cash in their fare collection systems. Payment with cash can be slow and back-end processing is generally labor intensive. In response to consumer desires, transit operators have sought to increase the range of payment mechanisms provided to riders. Rail systems have been relatively successful through sales at standalone ticket vending machines or at kiosks where online authorizations are readily achievable. Bus applications lend themselves less well to online processes.

The need to put cash into a farebox or vending device every day is a constant reminder to the consumer of transit's cost. Transit operators' adoption of new payment mechanisms is one attempt to address the consumer perception of transit cost, which puts using transit at a competitive disadvantage to driving an automobile.

2.2.5 Data Security and User Privacy

Recently enacted state and federal laws require that transit agencies (as merchants) protect the personal information collected and used for data mining regarding their riders/customers and provide notice regarding the handling of that information and the privacy policies.

Transit agencies, working together with the financial payments industry, must ensure the security and confidentiality of the customer record and information and protect it against anticipated threats or hazards to that security. Agencies must protect against unauthorized information access or use that would result in substantial harm or inconvenience to any customer by implementing a comprehensive security program.

2.3 Transit AFC Systems and Open Financial Payment Systems

To date, traditional financial and retail payment systems have not completely addressed the transit industry's requirements for speed, low cost, and functionality. As currently implemented at most transit properties, fare payment systems are typically solely-owned and custom-designed. Until recently, these AFC systems have functioned as closed systems, in most cases specifically designed for each operator, and have provided limited opportunity to share in economies of scale. This required transit agencies to set up an infrastructure that is more akin to financial payment systems (including issuing, acquiring, and processing functions) than to transit services.

Transit agencies in several areas of the United States have joined together to develop "regional" transportation networks. To do so, agencies have either built on the framework of their existing systems and expanded system use to other agencies, or collectively chosen to move ahead with a business or technical solution as a common approach for their region.

Even in moving ahead with the regional AFC systems, transit agencies typically must:

- Establish an infrastructure for card lifecycle management, including procurement, distribution, replacement and disposal.
- Create and maintain a network of devices to distribute and reload fare products.
- Establish a central clearinghouse for calculation and settlement of funds due among participating agencies.
- Create and maintain a complex customer service organization for fare media sales, patron inquiries, and dispute resolution.

Some transit agencies are interested in reducing, though not eliminating entirely, their role as an issuer of payment media and acquirer of transactions that they have had to assume in a closed AFC system, and instead become more like a merchant in an open payment system. To this end, transit agencies are interested in the extent to which traditional financial industry payment cards and/or networks can be used for transit fare payment applications.

While there are a number of approaches to achieve this, Section 4 of this white paper focuses on transit agency acceptance of the new contactless financial payment cards for fare payment directly at gates and on buses. Alternative implementation models are included in Section 6.

3 Financial Industry Directions

While the transit industry was investing in AFC systems, parallel developments were taking place in the financial industry: the introduction of contactless credit, debit and prepaid payment products; new programs and rules for low value transactions; and processing approaches that can handle micropayments cost effectively. These developments create opportunities for transit agencies to work with the financial industry to accept contactless financial payment devices and offer new payment mechanisms for the transit rider population.

3.1 Contactless Financial Payment

Since mid-2005, leading financial issuers have put over 13 million contactless financial payment devices into the hands of U.S. consumers. That number is expected to grow significantly in 2006. A number of institutions have announced programs to issue contactless cards and fobs to consumers, including credit, debit and prepaid products. Issuers in the United States include Advanta; American Express; Bank of America (MBNA); Citibank; Citizens Financial; HSBC Bank; GE Consumer Finance; JPMorgan Chase; KeyBank; Peoples Bank of Paris, Texas; and Wells Fargo. Visa and JPMorgan Chase have also launched a contactless mobile payment pilot in Atlanta, and Discover has announced that it will pilot contactless payments using mobile phones later this year. In addition, Peoples Trust Bank and Mint Technology in Canada are issuing contactless prepaid cards based on MasterCard® PayPass™ technology.

Introduction of contactless financial payment devices has focused on markets that have lower value transactions (less than \$25), where consumers use cash for payment, and where transaction speed and customer convenience are critical. Over 32,000 merchant locations in the U.S. are now accepting contactless payment, including quick service restaurants, convenience stores, pharmacies, theaters, and sports venues, among others. Both well-known national merchants (such as McDonald's, 7-Eleven, AMC Theaters, Regal Theaters, CVS/pharmacy and Arby's) and regional retailers (such as Wawa and Sheetz) have chosen to accept contactless payments.

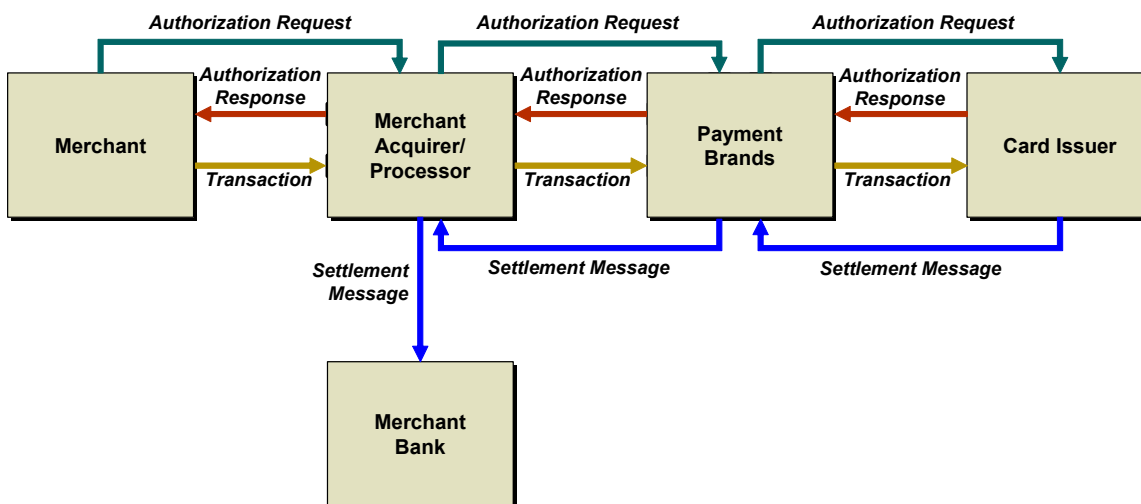
American Express, MasterCard, and Visa have selected ISO/IEC 14443 as the single contactless standard in the United States and have implemented contactless payment transactions so that they leverage the existing payments infrastructure. Contactless payment in the U.S. is simply another way to present the card to the point-of-sale (POS) system with little distinction between the functionality of the contactless payment card and the standard magnetic stripe card.

The flow of a traditional credit card payment transaction includes the following steps:

1. The merchant's point-of-sale (POS) system sends an authorization request for the transaction (including the cardholder account number and transaction amount) to the merchant acquirer/processor, who then sends it through the financial networks to the card issuer.
2. The issuer performs the necessary security checks (e.g., checking the security information included with the transaction, determining the validity of the payment card, analyzing cardholder behavior to assess if the transaction could be fraudulent), authorizes or denies the transaction, and returns an authorization response to the merchant acquirer/processor, who passes it to the merchant.
3. Authorized transactions are captured from the merchant every day, and a settlement message is sent over the financial networks to transfer funds to the merchant account (transaction amount less merchant discount rate)².

² See additional discussion in Section 3.3.

Figure 1: Credit Card Payment Transaction Flow³



The same flow applies to contactless financial payment transactions in the United States, with the following exceptions:

- Cardholder payment information is transferred to the POS system wirelessly, using radio frequency (RF) technology.
- The contactless transaction uses triple DES encryption to protect against fraudulent card use and includes additional security information that prevents the replay of transactions.
- After a traditional credit card transaction is approved, the merchant provides a sales receipt for the cardholder to sign. In many cases, merchants accepting contactless payment cards also participate in programs for low-value transactions (described in the following section); the consumer completes the transaction without signing a receipt.

3.2 New Rules for Low-Value Transactions

American Express, MasterCard,⁴ and Visa⁵ have implemented new programs and rules that apply to low value transactions in specific industries. The programs waive the requirement for a signature for participating merchants. Merchant segments include quick service restaurants, convenience stores, pharmacies, parking venues, gas stations, and movie theatres.⁶

These programs, which apply to both magnetic stripe and contactless transactions, may feature the following:

- No consumer signature is required when the transaction value is below a certain amount (typically \$25).⁷

³ Source: Booz Allen Hamilton. This figure shows the transaction flow in an 'open loop' payment network (such as MasterCard and Visa); it does not show transaction flow for a 'closed loop' payment network where the acquirer, network and issuer functions are performed by a single entity, such as American Express.

⁴ MasterCard Quick Payment Service program.

⁵ "Visa Takes Big Step into Small Ticket Payments; Visa Launches Programs to Expand Card Acceptance and Usage in Small Ticket Segments," Visa press release, April 11, 2006.

⁶ American Express, MasterCard, and Visa programs cover different merchant segments and program details vary by payment brand. This section is a general description of these programs that does not attempt to compare the programs.

⁷ Floor limits for these programs vary by payment brand and by merchant segment.

- A customer receipt is only required if requested by the cardholder.⁸
- The merchant generally has full chargeback protection for transactions that meet the requirements of these programs.
- Decreased processing rates for credit and debit transactions may be offered to merchants for transactions below a certain limit in certain merchant categories.

In general, transactions processed within the guidelines of these programs are authorized online. However, some payment brands may allow certain merchant categories to accept transactions offline and process them in a batch or in an aggregated manner. If a transaction is not authorized online at the time of payment, the merchant generally bears the risk for fraudulent cards and transactions and for cardholder chargebacks for certain reason codes.

Transactions processed as traditional payment transactions require a consumer signature and receipt. Whether a signature is obtained or not, the merchant may be liable for these transactions depending on the criteria used to process the transactions.

Additional detail on the current status of contactless payments initiatives in the United States can be found on the Smart Card Alliance Web site.⁹

3.3 New Approaches for Micropayments

Micropayments are generally defined as transactions for goods and services priced at \$5 or less. Retail POS-based micropayments for items such as newspapers, car washes, pay phones, parking meters, fast food, purchases from vending machines, and transit totaled \$1.32 trillion in 2003.¹⁰ While low value cash and coin purchases have characterized the market for POS-based micropayments for decades, new approaches to processing micropayments are making the use of financial payment products for these transactions more cost effective for both the merchant and the financial payments industry.

3.3.1 Credit/Debit Card Fee Structure

Credit and debit card fee structures vary by payment brand and fees are typically negotiated between the merchant and the acquirer/processor. Figure 1 illustrates the relationships between the various participants in a typical MasterCard and Visa payment card transaction. To understand the issues raised by micropayments, it is important to understand what fees may be paid by each participant in a MasterCard or Visa transaction¹¹:

- The consumer pays the account balance to the card issuer.
- The acquirer/processor (who is a service provider to the merchant) pays the merchant the transaction value minus a per-transaction fee called a *discount rate*. The discount rate includes an *interchange fee* and front- and back-end processing fees.
- The merchant's acquiring bank pays the interchange fee to the cardholder's issuing bank.

The discount rate is a fee for processing credit card transactions and handling the deposit of card funds into a merchant's bank account. The main component of the discount rate is the interchange fee. For a credit card purchase, the interchange fee includes both a variable amount (computed as a percentage of the transaction amount) and a fixed amount. Debit card payments have a similar fee structure with a lower interchange rate. For micropayments, the fixed portion of the interchange fee can be large enough to make accepting credit, debit and prepaid products

⁸ Regulation E requires that a consumer receipt for debit card transactions be made available. For more information, see <http://www.bankersonline.com/regs/205/205.html>.

⁹ A listing of contactless payments issuers and merchants accepting contactless payments can be found at <http://www.smartcardalliance.org>.

¹⁰ Source: Tower Group

¹¹ Fee structures for a 'closed loop' payment network where the acquirer, network and issuer functions are performed by a single entity, such as American Express, would follow a different model than the one discussed in this section.

uneconomical for merchants in some segments, unless an aggregation scenario is implemented. (See discussion below.)

Currently, many electronic payment networks operate in the market, each with different rules, regulations, operating costs, and procedures. Financial payment networks that are operated by the payment brands incur a number of costs, for investing in and maintaining the IT infrastructure, managing the acquisition of participants (getting consumers to apply for and carry cards and getting merchants to connect to the networks), and covering the risks of the transactions. The discount rate structures charged to the merchant were designed to pay for all of these transaction processing and infrastructure costs.

3.3.2 Processing Micropayments

While the fee methodology described above is suitable for traditional purchasing behavior, it can be expensive for merchants who sell products and services at micropayment prices. The size of the potential market, however, has attracted the attention of several stakeholders: credit/debit/prepaid product issuers who want to expand the use of their cards for cash transactions, merchants who want to replace cash without slowing service, and payment processors who want to increase transaction volumes. The result has been the introduction of a number of new approaches for processing micropayments cost effectively.

The Apple iTunes online store represents one example of how a merchant can successfully accept micropayments using the traditional financial payment processing networks. While it is possible for customers to purchase a single \$0.99 song for download, the iTunes approach minimizes single-item purchases and, in most cases, combines multiple individual downloads into one payment transaction. By internally aggregating a customer's purchases into one larger payment transaction, iTunes incurs only a single processing fee for multiple purchases.

An aggregation system identifies repeat transactions that use the same payment instrument (such as a credit card) and aggregates the charges up to a certain value or time to process a smaller number of higher value transactions. Some merchants with a high volume of low value transactions are now using aggregation as a technique for reducing the cost of financial payment card acceptance. A limited number of third party processors offer aggregation services.

Other approaches that may make micropayment transactions more cost-effective include:

- Subscription-based payment. An up-front payment covers "all you can buy" over a particular period of time.
- Prepaid account. An upfront payment is stored in a customer account and decremented as purchases are made.
- Postpaid account. Where an authorization is made upfront, transactions are aggregated and later settled when a threshold amount or timeframe is reached.
- Direct payment. Micropayments are billed individually and processed over standard payment networks, at fees ("discount") negotiated between the merchant and the acquirer/processor.

3.4 Financial Prepaid Cards

Over the last five years, the financial industry has significantly expanded the number of prepaid cards available to consumers. Consumers currently spend nearly \$100 billion through prepaid cards, the majority being through gift cards. Consumer awareness of prepaid cards is very high, driven primarily by the fast adoption of gift cards – over 80% of consumers received or gave a gift card in 2006.

Prepaid cards, as the name implies, are payment cards that have the ability to spend only the amount of money that was added prior to use. The term "prepaid" is used in this case to describe a card that is part of a host-based, online account management system, as opposed to a "stored value" card which is usually associated with a chip-based, offline account management system.

Some prepaid cards have values set at issuance and cannot be replenished. Other prepaid cards can be re-loaded with value through a variety of payment system networks. In most cases, these cards are “anonymous” and no credit is required in order to acquire them.

Prepaid cards can be branded with one of the payment brands, thus enabling use at the millions of merchants that are on their open networks. Alternatively, cards can be issued by closed systems, such as gift cards offered by retailers or shopping malls; these prepaid gift cards can be used at a specific retailer store or shopping mall.

Initially financial institutions controlled all aspects of the prepaid card business, from program design to marketing, processing and customer service. Then non-banks began to develop various product applications and contracted with banks to issue the cards for them in order to obtain access to the financial payment card networks.

A class of banks emerged to serve the market by providing access to MasterCard and Visa services and supporting clearing and settlement through their respective networks for program managers who take responsibility for marketing and distributing the prepaid cards.

Today, the prepaid market is largely controlled by two network issuers, a few processor issuers, a handful of large banks, and hundreds of program managers and marketing agents who issue network-branded cards through clearing and settlement banks.

Corporations and government agencies also make prepaid payroll cards available to their employees. These can include distribution of funds available through pre-tax funded benefit programs such as health savings accounts and transit benefits.

Government agencies also distribute a variety of prepaid benefit cards to replace checks. Some of these cards would be particularly suitable for use in transit systems as benefits recipients are often users of public transit.

Prepaid card distribution is evolving in several ways. Two common approaches are:

- Promotion agencies acting as marketing agents to sell promotional cards to consumer product companies who give them to their customers.
- Prepaid card distributors reselling many types of prepaid products to retailers who then distribute them to consumers.

Prepaid cards could fulfill an important role in supporting the collaboration and convergence between financial payment and transit fare payment. At present, however, only two small programs issue contactless prepaid cards, a requirement for any use in paying transit fares at the point of entry. There may be potential to expand this category.

From a transit perspective, interest in prepaid cards stems from the need to assure that all forms of fare payment are available to public transit customers. The benefits of fare payment using contactless instruments would have to extend to all customers, including the unbanked and the underbanked. One way of assuring access to a contactless fare payment option built on a financial payments industry solution would be through the use of widely available prepaid contactless cards.

As noted above, prepaid card solutions have already emerged for use in a general retail environment. Innovation is continuing to make these cards immediately available through automated vending machines without the need for an application and response from a centralized issuer. Market-driven solutions are also emerging that provide competitive pricing and revenue sharing opportunities.

4 Key Considerations for Transit Acceptance of Currently-Issued Contactless Financial Payment Cards

The transit and financial industries have taken different approaches to processing payments and managing risks. While both industries see opportunities to work together, both need to consider the differences in their business solutions in order to come up with an approach that will allow transit agencies to accept contactless credit, debit and prepaid devices for transit fare payment and further open the transit market to the financial payment industry.

For the purposes of the discussion in this section, a starting point for consideration of transit acceptance of contactless financial payment devices is the assumption that the current “merchant-acquirer-issuing bank” business relationship should be maintained. Maintaining this relationship will enable transit to take advantage of the broad-based, market-driven nature of the current global financial payments network model. The cost of a potential transit solution could thus be contained, and the solution could remain in a broadly competitive arena that relies on open standards for both equipment and services. Maintaining this relationship also can enable transit to build on established financial payment card customer behavior and expectations and leverage the extensive customer and operations support infrastructure already in place for financial payments.

Another assumption for the discussion in this section is that the current operating infrastructure of the financial payments system remains largely unchanged. While other implementation approaches are possible, starting from an existing baseline enables industry discussion to evaluate possible alternatives while carefully considering customer service and business needs.

This section describes one implementation approach where the transit industry uses the currently-issued contactless financial payment device as a static customer credential and uses the standard financial industry processes for clearing and settlement that rely on back-end processing. In this model consumers would use the contactless financial payment device that they received from their financial issuer to pay transit fares directly at the subway gate or on a bus.¹²

There are several key benefits for transit agencies to move to a transit fare payment solution that is built on this model.

- Customers paying fares with financial industry-issued contactless payment cards would be able to build on an existing relationship with an issuer of their choice to pay any transit fare. Customers would have fewer pieces of plastic in their wallets; regional travel on public transportation would be made easier.
- For customers, paying a transit fare would become like any other retail experience and carry with it the complete customer support system, claim resolution process, and protection against loss that comes with financial payment products.
- Transit agencies may no longer need to issue fare media for a large segment of its riders, possibly avoiding significant costs associated with ticket issuance and lifecycle management. Transit agencies could accrue the benefits of “account-based” fare payment without needing to directly manage and secure the privacy of those accounts.
- Transit would join the larger pool of retail merchants, issuing organizations, and payment brands that have agreed to and facilitated sharing of proven “open” standards as a basis for developing equipment and support processes. The economies of scale of the shared infrastructure (e.g., the existing open, non-proprietary, financial payments system) can provide opportunities for transit agencies to save costs by consolidating multiple clearing houses and customer service functions.

¹² See additional detail on two pilots that use this approach in Section 5.

- Transit would be well-positioned to take advantage of the growing trend toward non-cash payment options among consumers, which is expected to gain further momentum as state governments move toward using financial payment instruments for distribution of benefits.
- Interoperability is expanded among both transit agencies and all merchants that accept such payment devices. The effect of which, according to recent studies, is that the payment device becomes “top of wallet,” providing an increase in usage which is a motivator for financial service providers.
- Transit would benefit from co-branding opportunities and other promotional programs that promote the agency’s brand.
- Card issuers have become experts at database marketing and could work with the transit agency to identify segments of customers who are likely to respond to various product offerings. Using the account-based model, temporary promotional products could be introduced with little effort.
- Card issuers will be able to focus on promoting usage as this approach requires little, if any, change in operations.

For each transportation mode, public transit needs to define what it requires at a point of entry beyond basic financial payment functionality to satisfy its customer service and business needs. Key considerations center on the operating and business issues raised when individual public transit agencies become merchants, rather than on implementation issues concerning technology definition, standards, and technical infrastructure.

This section describes selected key challenges for implementing the approach described above and offers perspectives on how these challenges can be addressed. The section is not intended to describe all possible issues or advocate a single solution but to promote discussion among industry participants. Two possible alternative models for implementation are summarized in Section 6.

4.1 Transaction Time, Online Authorization, and Risk Management

Three key issues for transit agencies are transaction time, online transaction authorization, and risk management. These three issues are intertwined.

As described in Section 2.2, the transit fare payment transaction must occur very quickly—generally in less than 300 ms for the entire customer interface. Slower transactions may result in unacceptably slow customer throughput at gated transit systems and interfere with “normal” customer flows, especially in heavily used transit systems. For bus systems, speeds of 300 ms or less have enabled up to 30 percent reductions in dwell times at bus stops. Since dwell times account for up to 25 percent of total route times, not adhering to the 300 ms standard can have significant implications for customer service and cost.

Current transit AFC systems achieve this transaction time using established techniques that are now the basis of several international transit standards. In most cases these processes complete the card validation transaction at the point of entry offline. Purchase of fare product typically occurs away from the point of entry with the access transaction taking the form of either validating or debiting a prepaid instrument. Because any offline transaction carries a certain degree of risk, transit agencies have built certain functionalities into their fare payment systems that are essential in detecting and preventing fraud and managing risk. As is also true in the financial payments industry, transit agencies have taken a “layered” approach to risk management, which aims at prevention through a combination of pre-payment approaches, customer awareness and enforcement with assistance from law enforcement.

American Express, MasterCard, and Visa also incorporate security measures throughout their products and payment systems. Risk management techniques include online transaction

authorization and sophisticated back-end fraud detection systems. All payment brands generally require that contactless payment transactions be authorized online to manage risk (just as most magnetic stripe payment transactions are); while there may be exceptions to this policy, merchants generally bear the risk for fraud and chargebacks if transactions are not authorized online. However, the financial industry has established programs for low-value retail transactions (micropayments) that waive the requirement for a signature (described in Section 3.2) but still protect the merchant from fraud and chargebacks, eliminating this requirement as a throughput issue for transit acceptance of contactless financial payment devices.

The difference between offline and online authorization approaches in the two industries raises the following issues:

- A standard credit, debit or prepaid card transaction that is authorized online may be too slow for transit fare payment, absent high speed communications, or may not be feasible with an older transit communications system infrastructure.
- While GPRS and other 3G technologies are being proposed to include online authorization for buses, there is currently no widely deployed technical solution that allows online authorization on bus systems in the U.S.
- The financial industry's programs for supporting micropayments only partially address the needs and risks specific to a transit environment. Transit agencies accepting contactless financial payment devices without standard online authorization would be required to accept the risk of fraud and chargebacks.

Two approaches used in other industries could be applied to transit to help resolve these issues: transaction aggregation and prepaid accounts.

4.1.1 Transaction Aggregation

Aggregation identifies repeat transactions that use the same payment instrument (such as a credit card), aggregates the charges up to a certain value or time, and then processes the aggregated charges, thereby processing a smaller number of higher value transactions. This can result in lower fees than processing each micropayment transaction individually.

Successful introduction of transaction aggregation requires a thorough understanding of the risks involved. For a transit agency, the key to understanding these risks is to examine the agency's current experience with fraud and loss incurred by accepting financial payment products and predict what might happen if these payments are accepted at the point of entry. It is also important for transit agencies to work with financial industry representatives to understand the risk factors in the transit sector as compared to other merchant categories.

There are specific approaches that could be used to mitigate the risk associated with waiting until aggregation criteria are met. One possible solution is to perform an authorization on the initial use of the contactless payment device before a transaction is forwarded to the back office to begin the aggregation process. A transit agency may be willing to accept the additional time to authorize the rider's card online for this initial transaction since it qualifies that the payment device is in good standing with the financial issuer. Alternatively, an authorization could be done on the first use and subsequent information from that transaction could be posted to the transit back-end system. Risk would be limited to the first transaction provided that information on the results of the authorization could be made available at all points of entry to the transit system in real-time or as near real-time as possible. For transactions after the initial one, the system would need to conduct some risk analysis and possible risk assignment given the new financial industry rules that apply to transactions under certain floor limits. If, for the first transaction, the card is valid, the transit agency could have a high degree of confidence that the rider is a legitimate customer and may be willing to accept the risk until the aggregation criteria are met.

Use of transaction aggregation could offer two benefits. First, a majority of the transactions would be handled by systems located on the front-end of the payment network or internal to the transit system, improving response times and potentially reducing transaction fees. Second, the

aggregated bundles of transactions are processed over the existing financial payment networks, reducing the agency's risk of non-payment and fraud. Fraudulent cards would be identified during the initial authorization process and riders who attempt to ride with invalid or fraudulent cards would be identified within a few trips. This would, of course, depend on the robustness of information communication to the readers at the point of entry.

4.1.2 Transit Prepaid Accounts

Transit prepaid accounts structured around financial payment devices could allow a customer to fund an account with enough value to cover multiple transit rides. During this process, the customer could also choose from a menu of fare policy options offered by the transit agency. When a customer then uses the contactless payment device at the point of entry, the prepaid account would be decremented, with usage recorded or validated as well. The transit agency would incur one transaction processing fee for the initial amount (which is significantly larger than a single fare), with no additional payment processing fees.

By instituting the use of prepaid accounts, the transit agency could require riders to prefund a transit-specific account for use with their contactless financial payment devices. When the account is funded, the "funding" transaction would be authorized online, validating the payment device and account and providing funds to the transit agency to pay for the rider's use of the transit system. In this example, when a commuter arriving at a subway station uses a contactless financial payment device to enter at the gate, the transaction amount would be decremented from the transit account in the back-end system, either in real time or on a schedule. Since the rider already paid the fare, the risk of non-payment or fraud is reduced.

If the contactless financial payment device used by the customer at the point of entry is not modified for transit fare payment, then the customer's transit experience would be similar to any retail purchasing experience. The acceptance process would also be simplified, since the customer had already made arrangements for the desired type of fare. Provided that the cardholder account is not "hotlisted," entry to the transit system would be assured. As with any account-based system where the customer is known to the account provider, risk could be mitigated because the customer and the account provider have an established relationship. In this case, since the contactless payment device and the account are held by the financial issuing institution and the use of the contactless device encompasses a broader financial relationship, the customer would have a vested interest in maintaining the account in good standing.

4.1.3 Offline Transactions

Transit agencies have the option of processing payment transactions offline, using floor limits. However, this approach could incur financial losses due to fraud and the related fees charged by the payment brands. Merchants could also risk compromising their standing as part of the payment brand's merchant network.

4.1.4 Summary

All three approaches assume that transit agencies can accept some or all contactless transactions without requiring online authorization every time the contactless payment instrument is presented at a point of entry.¹³

Implementation of a model that doesn't authorize every transaction requires further discussion between the transit and financial industries, development of models and procedures to manage risk and prevent an increase in fraud, and, possibly, implementation of additional fraud controls

¹³ It is important to note, however, that there is no technical reason preventing full online authorization of transactions, even if the authorization is obtained after allowing entry to the system. The decision of whether to authorize every transaction is a matter of cost, risk and time (if authorization is desired prior to opening the gate or allowing a passenger to board).

by transit agencies and/or financial processors to address risk. It is critical to define an implementation approach that has an acceptable level of expense and risk for both the transit and financial industries.

One step essential to resolving the issues of transaction authorization is for individual transit agencies (and perhaps public transit as an industry) to understand and quantify the financial risk involved in becoming a merchant who accepts contactless devices for payment at the point of entry. Several factors need to be considered to create a business and financial risk profile for this approach.

First, the dollar value of transit fares is generally less than the dollar value of transactions performed at a typical retailer location. Most transit fares fall into the category of micropayments, and while other fare options (particularly those for commuter heavy rail) have a higher value, the transaction value is narrower than the range experienced by most retailers. In today's fare collections systems, transit agencies use financial payment cards to add value to their closed payment systems as consumers purchase tickets or load fare products to their transit cards using one of several load value options.¹⁴ These transactions are often above \$20, include an authorization, and are subject to normal financial payment industry rules. In these current implementations, the fare payment transaction is controlled by the proprietary system used by each transit agency and not by the financial payment system. As a result, the risk of fraud or non-payment is internal to the transit agency. Transit agencies have used this approach for some time and have gained substantial experience with the fraud issues associated with financial payment card acceptance used in this manner.

The new processing approaches described in this section were designed to accommodate the direct use of financial payment cards for micropayments. As in other industries, the rules for processing are expected to change with experience until the right balance of cost and control is achieved.

It is important to note that there are risks taken by financial issuers and transit agencies regardless of which approach is used, and that fraud prevention is a dynamic process that requires continual effort by all involved.

Second, unlike most current public transit customers, a transit "retail" customer using a financial payment device would not be anonymous. While the customer may still remain anonymous to the transit agency, the customer has voluntarily identified himself to the issuing bank. This is a distinct advantage to merchants when taking preventive measures to reduce financial risk and prevent fraud.

These considerations, along with information emerging as a result of discussions between transit agencies and potential financial industry and/or data and transaction processing partners, can be used to create a risk profile for public transit. This risk profile could be used to define an approach to authorization and floor limits that is appropriate to public transit and acceptable to financial industry partners. The resulting risk profile could then be used to create business, operating, and technical guidelines that are reflected in the approach that the transit industry uses to accept contactless financial payment products for fare payment.

4.2 Transaction Costs

Transit agencies interested in accepting contactless financial payment devices at a gate or turnstile or on a bus must understand the transaction processing fees charged by the financial payments industry. Payments for individual transit trips are micropayments. As described in Section 3.3, micropayments may be expensive to process using traditional credit and debit card payment processing for each transaction. However, the use of aggregation and prepaid accounts (described in Section 4.1) can help reduce the cost of processing low-value transactions. It is

¹⁴ Load value options include ticket vending machines, telephone- and web-based services, and customer service locations.

also important to remember that many of the programs supporting micropayments are new to the market and that the business model for these programs could evolve over time, resulting in changes to both processing rules and fees.

Transit agencies could also opt to process each fare payment transaction individually and incur whatever processing fees they negotiate with their acquiring bank. Since most transit agencies already accept financial payment products for fare payment, information on potential incremental costs should be readily available.

The development of a business model that includes both transaction processing costs and any savings that could be realized from reduced cash handling and fare media costs would help agencies determine whether contactless credit, debit and prepaid payment acceptance is economical.

4.3 Transit Fare Policy and Processes

A key consideration for transit agencies is how to make the agency's different fare policy options available to customers if contactless financial payment devices are accepted for fare payment at a point of entry. As described in Section 2.2, transit fare structures typically start with basic per-trip charges and then add rules that address whatever unique transportation services the agency offers in response to customer demands and the specific rider populations served (for example, student fares, reduced fares for the elderly and handicapped).

In addition, transit agencies typically use a combination of different fare media. For example, even agencies that have implemented a contactless smart card-based AFC system still use cash, paper passes, and magnetic stripe tickets in addition to smart cards.

One possible approach to addressing fare policy when accepting contactless financial payment devices directly at a subway gate or on a bus would be to handle the fare calculation in a back-end account-based system. One example of how this approach has been implemented is the business and technical model used for toll roads that accept EZ-Pass, FasTrak, and other electronic toll payment mechanisms. These are custom-built, non-financial systems that rely on a back office to calculate and centrally clear all tolls for multiple participating agencies. Participants in these systems use a standardized transponder with an electronic serial number that identifies the user within the system. Each user has an associated account which includes details about the type of vehicle and, therefore, toll to be charged. The information stored in the transponder is static and may be limited to a serial number or may include additional data, such as a rider class or expiration date. The payment device at the toll booth confirms the validity of the transponder. Throughout the day, data on usage at the toll gate is uploaded periodically to the central system. A process of clearing and settlement levies the appropriate charges against the user's account and, when different tolling agencies are involved, apportions funds between those agencies. These systems also offer a mechanism that automatically replenishes the user's account once a certain dollar threshold is reached. One of the payment options for the customer is to identify a credit card to be billed.

It is reasonable to assume that a similar account-based system could be designed and implemented for transit fare payment, processing the transit equivalent of passes, transfers, and other fare instruments required by a transit agency just as contactless smart card-based AFC systems currently do.

Transit agencies who prefer not to implement an account-based system could restrict the use of contactless financial payment devices to payment of fixed fares directly on buses or at gates or to pay for transit-specific fare media, as is currently implemented for magnetic stripe credit and debit cards.

Fare policies and processes are also shaped by the mode of transit. APTA's 2006 Public Transportation Fact Book reports the following statistics for unlinked passenger trips by mode for 2004:

• Bus	59%
• Heavy rail (subways, metro)	28.7%
• Commuter rail	4.3%
• Light rail (streetcar, tramway)	3.7%
• Paratransit	1.2%
• Trolley bus	1.1%
• Other	1.2%

The fare policies and processes for the major transit modes are explored in more detail in the next sections.

4.3.1 Fare Policy and Processes in Heavy Rail (Subways, Metro)

Public transit systems rely heavily on ticketing both as a means of collecting fares and as proof of purchase. However, as AFC systems for subways have evolved, tickets in the form of magnetic stripe cards and contactless smart cards carry few (if any) visible indications of the type, validity, or current inherent value of the ticket. Few subway systems require customers to present proof of payment any longer, in large part because most subway systems are gated.

When fare media carry no visual identification, external signals on the fare payment devices alert enforcement personnel to riders who are using concession fare instruments. Personnel can use these signals to challenge patrons who do not appear to be qualified for the product being used (for example, a 40-year-old man carrying a briefcase and wearing a business suit but using a public school student pass).

For heavy rail, which includes both commuter and long-distance train service, the situation is different. Ticketing operations on trains are determined by multiple policies and procedures that are difficult to modify. Despite significant disincentives, for example, on-board ticket sales are likely to continue. Passengers may still be required to show proof of payment (POP) to transit personnel, and transit personnel will continue to issue seat checks to expedite visual inspection of tickets held by recently boarded passengers.

To accept contactless financial payment devices in these environments, public transit and financial payment providers will need to develop a solution that enables both sale of tickets and visual inspection. Customers can already purchase tickets on board using magnetic stripe credit and debit cards. The use of contactless handheld sales devices that support acceptance of contactless credit, debit and prepaid devices is a logical next step. It is also a step supported by most contactless smart card-based AFC systems, where the handheld device is used to validate a product, reload a product, or collect a stored value fare.

A more difficult challenge is how to provide a surrogate for visual inspection of prepaid tickets, particularly passes and other time-stamped instruments, and for single-use tickets that carry visual identifiers of origin and destination. Public transit can certainly define what is necessary and acceptable, but in the end the technical solution may be chosen to accommodate a broader market solution.

Other means of addressing this challenge may be necessary. Public transit must often provide a wide variety of options to fulfill its mandate of inclusiveness and accessibility. For example, one option for commuter heavy rail could be to require passengers to present their contactless payment card on boarding and then again in the destination station. The second use would be required in order to charge the correct fare. Failure to present the contactless payment card at the destination would result in the charge of a maximum fare, or even possibly a penalty. It is important to note that the volume of passengers at destination stations needs to be considered if this approach is implemented, since throughput could be seriously affected if there are not sufficient numbers of exit contactless readers. This approach could obviate the need for comprehensive on-board inspection while still permitting random inspections for proof of payment. The enforcement agent could require the customer to present the contactless card or device to a special handheld device. Subsequently, the back office could compare the records to

other processing records, checking for the presentation of a card both at boarding and at a destination station.

4.3.2 Fare Policy and Processes for Systems Using POP Fare Collection Practices

The use of contactless financial payment devices in the open (non-barrier) systems that are often typical of light rail, bus rapid transit (BRT), and commuter rail systems presents some unique challenges. Non-barrier systems use POP fare collection practices.

As noted in the Federal Transit Administration's reference guide,¹⁵ in a POP system "passengers must board with either a pass or a validated ticket, and can be asked to show proof of payment at any time. Inspectors randomly board [vehicles] and give fines to passengers who cannot show the required pass or ticket." This type of fare collection requires a solution that is similar to but independent of any solution for traditional bus and subway systems. In addition, any solution must meet the needs of both the transit and financial industries.

One solution that could be implemented is the ability to print a receipt for POP. In this scenario, the contactless credit, debit or prepaid device could be presented to a ticket vending or fare validation device that can print. Once the card is validated or processed by the equipment, a receipt would be issued to the patron, and all relevant transaction data would be stored for processing by the transit and financial payment systems. Such equipment is often available at stations or platforms, thus allowing for real-time transaction authorization, although it could be placed on board vehicles at the doorway. The receipt could then be visually inspected by transit personnel to verify that the patron paid the proper fare.

A different approach would be needed when the transit system's fare equipment cannot issue a receipt. In this case, a customer could present a contactless financial payment device to a validation device that would acknowledge the transaction (using audio or visual indicators) but would not issue a separate printout to allow for visual inspection. There can be several options for what happens next. For example, the device could store the transaction information to be downloaded and processed by the payment system at a later time. On-board verification would be accomplished by transit personnel using a handheld device for random inspections of customer cards. The handheld device could store card and transaction information and download it later to a central computer system. Once the central system had the data from both the validation device and the handheld device, it could check to ensure that cards presented to the handheld device were also properly validated. In the event that a payment device was not validated properly, the agency could charge the contactless financial payment account for the fare and possibly include additional fees or fines for lack of payment.

Another solution could require the transfer of data from the validating equipment to the handheld device. This transfer could be accomplished using wireless connectivity, although such a solution would probably require significant upgrades in applicable infrastructure and real-time communications. If the validating equipment were on board, data would be transferred to the handheld unit on board. Once the handheld unit was updated, inspectors could check to determine whether riders had paid their fares before boarding the vehicle.

Clearly, these last two solutions present many issues, including issues involving the security of stored data and the use of financial payment card information as identification data. However, preregistration of contactless financial payment cards (where the customer registers with the transit agency and indicates the financial account that will be used for fare payment) could resolve many of these issues through back-office processing by the agency's central computer system.

¹⁵ *Federal Transit Administration Bus Rapid Transit Reference Guide*, 2003, http://www.fta.dot.gov/2340_7254_ENG_HTML.htm.

4.3.3 Fare Policy and Processes in Bus Systems

If open financial payment systems are to be seriously considered for widespread adoption as a viable alternative to closed AFC systems, they must address the specific challenges related to transit bus fare collection. The major portion of public transit riders in the United States use buses. According to APTA's 2006 Public Transportation Fact Book, of the total 9.6 billion public transportation passenger trips taken in 2004, 5.7 billion were bus trips. More than 300 transit properties provide bus service, with a total combined fleet of more than 54,000 vehicles. Transit agencies offer a wide variety of bus services, serving diverse customer demographics and fulfilling a broad range of operating and business requirements.

Buses represent an economical and highly flexible option for introducing public transportation into new areas or supplementing other modes of transportation when the infrastructure investment is constrained. In terms of service frequency and diversity, service implementation runs the gamut. For example, it includes intermittent service by a handful of buses traveling relatively long distances with light passenger loads to connect small towns and population centers to key destinations (such as shopping malls and senior centers). It also includes service in major urban and suburban centers, where customer demand requires frequent stops, multiple routes and service types (e.g., local and express), and a complex operating and business infrastructure supporting a bus fleet numbering in the thousands of vehicles.

Operating equipment and procedures governing bus service are equally diverse, and often complex as a result of "local" practices. Given the nature of these over-the-road operations, accepting contactless payment devices based on financial payment systems presents its own unique set of challenges. When systems require customers to pay or to show proof of payment upon boarding, common practice is for the customer to board using the front (sometimes the only) door, in full view of the bus driver. In flat fare systems, the customer pays a flat fare at the point of entry for all transportation modes. Zone- or distance-based fare policies present a different challenge. Zone-based gated light- or heavy-rail systems require validation at both the entry and exit points. This is made relatively easier, since the zones coincide with fixed physical barriers through which customers must pass. Because buses typically pass through multiple zones as they traverse their route, the issue is how to assure that the appropriate fare is collected without compromising customer convenience. One requirement for such a system is that it must be able to identify the bus location at each stop, and be able to calculate the correct fare that customers are to be charged based on where they board and leave the bus.

Current closed AFC system design typically requires customers to validate on boarding and on departing, thus establishing the location criteria required to charge the appropriate fare. Assuring that customers validated twice could be accomplished by programming the payment system to charge the customer the maximum possible fare when the second validation is missing.

Another approach requires driver interaction with the customer on boarding. This interaction occurs now on some bus systems, with the driver issuing a ticket for the zones paid for by the customer. If a contactless financial payment device were used, the driver could identify the fare zone for which the customer wished to pay to the on-board system. This solution would result in a two-step validation process. This process has the potential for error and fare evasion; it may also slow travel times and, therefore may not lead to improved dwell times at stops and operating savings normally associated with the introduction of contactless smart cards for fare payment.

One further consideration in creating linkages between bus operations and financial payments is the assignment of buses for service. Bus assignments are determined by the availability of the number of buses required to make peak service at pullout. A particular bus at a particular depot is assigned to a route during pullout (ignoring the rotation of vehicles to different depots, which can result in completely different route and service assignments). The point-of-entry reader would need to be synchronized at each new assignment to associate a payment transaction with a particular route.

Last, the cost of air time has prevented efforts to communicate fare payment information while the bus is in service. As wireless bandwidth increases and air time charges fall, this practice may

change so that buses will communicate transaction data in real-time or near-real-time. However, any new AFC system to be implemented in the foreseeable future will most likely need to manage bus transactions offline.

Acceptance of the currently-issued contactless credit, debit and prepaid cards on buses may require transit agencies to consider changes to their fare collection practices and bus fare collection devices, especially if customer interaction with the fare box or other registering device changes. The offline nature of bus operations also requires transit agencies to assess the payment risk and to develop business and technical approaches to manage this risk. However, a significant effort is warranted to resolve these challenges.

4.4 Financial Payment System Regulations and Operating Rules

Financial payments systems operate within a supervisory and regulatory framework that includes laws (such as the Electronic Funds Transfer Act and the Truth in Lending Act) and regulations (such as Regulation E and Regulation Z). In addition, each payment system is subject to a set of operating rules that describe the rights, responsibilities, and obligations of participants in a payment transaction; transaction processing; funds transfer requirements; and privacy and security requirements.

Three examples of financial industry requirements are discussed below to illustrate the types of issues that need to be addressed.

Customer receipts. Regulation E requires that a consumer receipt be made available, upon request, for electronic funds transfers (i.e., debit and automated teller machine transactions).¹⁶ While it does not specifically address credit card transactions, some financial payment card issuers apply this Federal Reserve regulation to credit transactions as well in order to make the consumer interface consistent for both credit and debit transactions. Printing a receipt at a subway turnstile or on a bus is typically not feasible, making compliance with this requirement an issue. Additional discussion with the financial industry is needed to determine acceptable practices for receipts in the transit industry. See Section 5.1 for a description of the New York City Transit pilot implementation of receipts.

Data security. Another example is data security. Transit agencies have the responsibility and obligation to comply with state and federal mandates regarding the handling of consumer information as well as privacy notice requirements (privacy statements) regarding the handling of same. In addition, there must be adequate protection from hackers via firewalls and encryption of data over virtual private networks. The financial payments industry has also issued strict guidelines for protecting cardholder payment information wherever it resides.¹⁷ Transit agencies need to design any systems that accept contactless financial payment devices at a point of entry and that handle or store cardholder and payment information to comply with these data security requirements.

Terminal, software and network certification. Newly mandated security provisions require terminal, software, and network certification and restrict changes that can be made without compromising the certifications. As the fare payment terminal carries out several non-payment related functions (e.g., security, access control, asset management), downloaded software and firmware updates are commonplace. Transit agencies must consider the operational impact of maintaining system compliance in this environment.

Transit acceptance of contactless financial payment devices at a gate or on a bus introduces a new usage model. The transit and financial industries must work together to assess the impact of industry regulation on system implementation and agree on approaches that can comply with the appropriate financial payment industry requirements.

¹⁶ <http://www.bankersonline.com/regs/205/205.html>.

¹⁷ Visa Cardholder Information Security Program (CISP) (<http://www.visa.com/cisp>), MasterCard Site Data Protection Program (<https://sdp.mastercardintl.com>), American Express Data Security Operating Policy, and Payment Card Industry Data Security Standard (PCI).

4.5 Summary

This section covers only a few of the challenges that transit agencies must consider in evaluating whether to accept the currently-issued contactless financial payment devices for fare payment at points of entry. However, the discussion does demonstrate that there are approaches that can address the challenges. If the transit and financial industries are to take advantage of the opportunity to increase the use of contactless financial payment products for transit fare payment, they must work together to develop business and risk models that can satisfy both industries' requirements.

5 Transit and Financial Linkages: New Transit Pilots

New financial industry support for contactless payment and micropayments offers opportunities for the transit industry. Contactless financial payment products (credit, debit and prepaid cards and devices) with the operational characteristics needed for transit and changes to the rules and methods for processing low value payments offer the potential for transit agencies to accept standard financial industry contactless payment cards for fare payment at turnstiles or gates and on buses.

Two pilots are currently underway to evaluate such systems. One uses contactless financial payment devices to pay at subway turnstiles in New York City. The other uses contactless financial payment devices to pay on buses in Salt Lake City, UT.

5.1 MTA New York City Transit Pilot Trial of Bank-Issued Contactless Smart Card Devices¹⁸

On July 11, 2006, in partnership with MasterCard and Citibank, MTA New York City Transit (NYCT) officially launched a trial of standard, contactless bank-issued smart card devices to pay transit fares directly at the point of entry without the need to purchase fare media. The trial, which is scheduled to last six months, was implemented at 30 subway stations principally along NYCT's heavily traveled Lexington Avenue line. At each staffed point of entry in these stations, one fare gate has been equipped with a standard ISO/IEC 14443 and MasterCard *PayPass*TM-certified smart card reader. For the sake of easy recognition, the reader and the fare gate were branded with a logo designed specifically for the pilot. These fare gates also continue to accept NYCT's current fare media, the MetroCard.

Through Citibank, customers participating in the trial have the option of selecting a smart card device that looks like a standard credit or debit card (which includes the traditional magnetic stripe) or a key fob. Whether the device functions as a credit or debit card depends on the individual customer's relationship with the bank.

MTA New York City Transit is one of the largest public transportation agencies in the world. With annual revenues of \$2.8 billion, its combined subway and bus services provide nearly 7 million daily passenger trips in the five boroughs of New York City, most of which are paid using the MetroCard automated fare collection system. With the agencies that operate commuter railroads, bridges and tunnels, and additional bus services, the parent Metropolitan Transportation Authority provides customers in twelve counties with a multi-modal, regional transportation network.

5.1.1 *Using Financial Instruments to Pay Transit Fares*

The approach being demonstrated at NYCT brings together the technical capabilities of smart cards and links them with the operating and business infrastructure of the financial payments industry. Like a typical magnetic stripe credit, debit or prepaid card used for retail purchases, the bank-issued contactless device in the demonstration acts to initiate processing of a transaction that ultimately is completed at the "back-end." The fare gate in the subway system (or any other point of entry for payment) acts like a point-of-sale device in a retail merchant location. The smart card device is "static," with no writing to the device. What enables the acceptance of the contactless device at a speed of 300 milliseconds or less are the business rules that can apply to customer-activated terminals for purchases under a certain dollar limit.

This approach merges the customer's experience of purchasing at a retail merchant with fare payment. Instead of purchasing and carrying transit-specific fare media, the customer would use a financial institution's contactless payment device at any transit property (or other retailer) that accepts financial payments (magnetic stripe or contactless). This leverages the benefits of an

¹⁸ "MasterCard and Citi Conduct Consumer Trial of Contactless Payments with MTA in Select NYC Subway Stations," MasterCard press release, January 30, 2006

account-based relationship the customer has with the financial institution, which in turn is supported by the financial institution's customer relationship management and by a governmental and bank regulatory matrix that favors the customer.

From transit's perspective, the agency takes on a greater role as a "merchant," with the chief commodity being sold the actual trips or rides (not "tickets" and other proofs of payment). Underpinning this merchant relationship are proven, widely-used standards for acceptance of financial payments (including smart card or contactless devices) that are "open" and readily available to merchants and suppliers of equipment and services. By expanding participation in the larger pool of retail merchants, transit leverages the resources of payment brands (e.g., MasterCard) and financial institutions that focus on risk management and on technology upgrades that are required to assure system performance.

5.1.2 Factors Shaping the Final Design and Scope

Several factors influenced the business requirements and scope of the trial. A key goal was to develop a solution that built on the financial payment systems already in place and on the customer's relationships and expectations when using credit and debit cards for purchases. Contactless financial payment devices had already been tested extensively in the marketplace, both from a technical standpoint and customer acceptance perspective. What remained was to identify the necessary technical, business, operational, and customer service enhancements that are needed to enable successful use of contactless financial payment devices when paying transit fares at the point of entry.

From the customer's perspective, it was important to assure that the speed of acceptance of the contactless device at the fare gate or point of entry did not interfere with normal entry flows. Appropriate messaging, both visual and audible, indicating that payment was made also had to be provided. Most important, the customer needed a support mechanism that could permit selection of any fare media option offered by NYCT and that would allow the customer to learn more about the features and functionality of the trial, review billing and usage activity, and obtain receipts. The support mechanism would have to be easily accessible and convenient, permit customers to make changes to initial choices, and provide a conduit for resolving any issues.

A concern for NYCT and its partners was assuring the integrity and security of the system as customers were billed for fares and NYCT was paid. A mutual requirement was that funds would be processed and cleared like any other electronic payment transaction, in the same timely manner as they do when customers purchase MetroCards at vending machines. There would be no issues of a loss of "float."

It was also agreed that the system developed to support the trial would replicate all data currently used by NYCT to track and report on sales transactions, payment of funds, and travel usage data. This was essential, since NYCT uses this data not only for financial reporting, but also as part of its overall efforts to manage fare collection risk and service scheduling.

There were also several practical considerations. While there was the possibility of permitting customers to choose from among all fare policy options, doing so would expand the scope of the trial beyond what was feasible financially, or even necessary for the purpose of evaluating performance of the system. NYCT research confirmed that customers who used passes tended to travel in less predictable patterns that involved both buses and subways. It would be difficult to keep the scope of the trial manageable, and less likely that customers would be able to use the contactless devices for both ends of their trip if passes were included. Driven by these operating concerns, the partners agreed to offer fare policy choices that allowed the customer to pay for one trip at a time or to take advantage of NYCT's 20 percent bonus. It was also determined that NYCT's Lexington Avenue subway line, which serves nearly 900,000 riders daily, would supply a large enough base of customers who could use the contactless devices for both ends of their trip, and, would be more likely, therefore, to participate in the trial.

5.1.3 How the Trial Works

To support the trial, MasterCard and Citibank worked with NYCT to develop and implement a web site as well as a staffed customer service center to support the project. The web site, <http://www.mastercard.com/subwaytrial>, provides online, password-protected customer access to their transit account activity and detailed information about the program. Also provided is a staffed customer service center with toll-free access to permit customers to deal directly with an agent. In turn, these customer interfaces are supported by a back office that assures all transaction processing and data exchanges occur. The back office also monitors and reports on the operating system for the contactless device readers in the field locations and permits coordination of maintenance and servicing activities with NYCT personnel who are providing supervised access in the field.

Citibank customers who have a contactless payment device powered by *PayPass*[™] (either a key fob or the standard plastic credit or debit card embedded with a contactless smart chip) can participate in the trial. They have two options on how to pay transit fares. One is simply to use the Citi payment device at the fare gate that bears the unique branding and markings designed specifically for the trial. No special preparations or arrangements are necessary to do so. The customer will be charged the regular full fare of \$2.00 for each trip taken.

To support this customer payment choice, MasterCard and Citibank implemented a process of transaction aggregation. This simply allows individual \$2.00 transactions attributable to the same account to be pooled into a single, larger-value transaction. This is beneficial to the transit agency, since it eliminates multiple charges for clearing and settlement. For the trial, the partners are testing an aggregation that is triggered by either a predetermined number of trips or a predetermined period of time, whichever comes first.

The customer in this case will see a single charge on their billing statement from Citibank in an amount from \$2.00 to \$20.00, depending on usage over the period of time set by NYCT. If customers would like more detail about the individual trips taken, they have the option of contacting the customer service center or registering on the web site. In both cases, details about each trip as to location, time, billing and receipt options are available.

Another choice for customers is the pre-funded fare option. Either via the web or the customer service center, a customer can register to pre-fund fares, much as they do today with the MetroCard. For the trial, the partners elected to set the pre-payment amount at \$20.00 and to enable automatic replenishment when the balance falls below a predetermined amount. Predetermined amount decisions were based on historic information about the average dollar value of purchases of MetroCards with credit and debit cards at NYCT vending machines. Once pre-registered, these customers also have password-protected access to details about every ride, billings, and recurring billings and also have receipt options.

In addition to the external operating and support system provided by MasterCard, NYCT adapted its internal systems to enable full review and reporting on the trial. Through a data mart, NYCT has implemented functionality that generates financial reports to its controller's office and ridership and revenue reports for budgeting and planning purposes. This was in part possible because of the ability to establish separate merchant identification numbers for the two payment options in the trial. This permitted segregation of the clearing and settlement of bank charges, and sufficient detail to allow reconciliation of ride information to each payment transaction.

5.2 Electronic Fare Collection Pilot for Utah Transit Authority Ski Service¹⁹

The Utah Transit Authority (UTA) is undertaking a pilot of contactless media fare collection in 2006. Readers for contactless payment will be installed on 41 UTA Ski Service buses and used to track acceptance and use of ski resort season passes, employee IDs, and cards issued by the Salt Lake Visitor's Bureau as bus passes. The pilot will include use of the readers as POS devices for micropayment transactions using contactless financial payment devices issued by the major financial payment brands (American Express, Mastercard and Visa).

The pilot will be conducted during the 2006-2007 ski season, from November or December 2006 to April 2007. UTA plans to have the system in place, tested, and accepted by the end of September 2006.

5.2.1 Utah Transit Authority

UTA serves six primarily urban counties along the Wasatch Front with a population of 1.9 million people covering an area of 1,400 square miles. UTA is the only major transit operator in the region. The agency operates 489 peak-period buses in regular service, 41 buses in special ski service, and 80 paratransit vehicles. The TRAX light-rail line operates 46 vehicles on two lines for a total of 18 miles. Fare collection is through a POP honor system. Commuter rail service is to start in 2008 with an initial 44-mile-long line. Plans call for a POP zone-based fare system.

UTA provides 32 million trips per year with a \$136-million operating budget. It has a 14% operating ratio, with \$20 million collected as fares. Pass products are responsible for 70%–80% of fare revenue. These products include the Ed Pass program, which allows students to use their student IDs as passes; the Eco Pass program for employers, who issue passes to all their employees; and period passes sold at retail outlets throughout the region. Cash collections through fare boxes total \$3.5 million. The basic adult cash fare is \$1.50 and includes a two-hour transfer. The one-way fare for ski service is \$3.00.

There is currently no automated fare collection mechanism. The fare boxes on buses collect and secure coins and currency but neither register nor validate fares, nor do they collect any data. TRAX light-rail ticket vending machines issue paper tickets, accepting only cash and tokens.

5.2.2 UTA Ski Service

UTA provides ski service in Salt Lake County to the Alta and Snowbird ski resorts in Little Cottonwood Canyon and to the Solitude and Brighton ski resorts in Big Cottonwood Canyon. A major portion of the ski service is centered on the 7200 South/Fort Union Blvd. corridor from the Fort Union TRAX Station in Midvale. Other areas served are the South Towne Center Mall area, the Sandy Civic Center TRAX Station, sections of 9400 South, Highland Drive (2000 East) in Sandy, and Wasatch Blvd.

Service is provided to seven exclusive park-and-ride lots, including those at the TRAX stations, and numerous joint-use park-and-ride lots in the valley. A total of six routes (three in each canyon) provide service from the Salt Lake valley to the ski resorts. In addition, the Alta Shuttle provides service between the two Alta parking lots and is paid for by the Alta Ski Resort.

5.2.3 Ski Service Pilot Project

The UTA electronic fare collection project has multiple purposes.

First, it addresses an immediate problem. The project uses electronic fare collection (EFC) technology to account for the use of season and period passes, employee IDs issued by four ski

¹⁹ Questions or comments regarding the UTA project should be directed to Craig Roberts, Manager, Electronic Fare Collection & Technology Development, Utah Transit Authority, 3600 South 700 West, Salt Lake City, UT 84119, 801-287-2218, 801-897-8201(mobile), Fax 801-287-4614, croberts@uta.cog.ut.us.

resorts, and passes issued by the Salt Lake Visitor's Bureau that are accepted by UTA as bus passes for special service provided from the Salt Lake valley to the ski resorts.

Second, the project is intended to familiarize UTA and its external and internal stakeholders (including managers, employees, board members, business partners, customers, media, and the general public) with EFC.

Third, the project will help UTA develop an understanding of certain issues that need to be addressed to facilitate full deployment of EFC. These issues include:

- Technical and institutional system integration challenges
- Opportunities and challenges associated with acceptance of financial payment industry media (American Express, MasterCard and Visa contactless credit and debit cards) for fare payment
- Required internal capabilities for managing electronic fare collection projects
- A process for technical system development that incorporates collaboration with contractors, iterative prototyping and testing, and use of open systems
- Exploration of "account-based" approaches for contactless electronic fare collection

The project will include the following elements:

- Installation of contactless readers (ISO/IEC 14443-compliant, both Types A and B) along with data storage and wireless (WIFI) communications devices on 41 UTA buses used for ski bus service in Big and Little Cottonwood Canyons
- Use of readers to read season and period passes, including ski passes and the employee IDs issued by ski resorts on media stock provided by the pilot
- Processing of single-trip payments or aggregated charges using new contactless payment media (credit and debit cards) issued by American Express (*ExpressPay from American Express™*), MasterCard (*PayPass™*), and Visa (Visa Contactless), and with UTA serving as a merchant
- Development of linkages from the reader to the existing UTA operator console/display (UTA will take the lead in creating the display modifications and establishing necessary linkages or interfaces, with contractor support.)
- Collection of data describing passenger boardings, including time, date, and location data using a global positioning system
- Use of WIFI bus-to-garage communications to upload and download electronic fare collection data.
- Simple back office operations, including the following:
 - Accounting for trips taken with passes.
 - Storing and forwarding contactless credit and debit card transactions from buses to facility servers and clearing financial payment transactions through an acquirer/processor.
 - Distribution of pass product-coded contactless cards through ski resort partners and UTA distribution outlets. Common card stock with magnetic stripes, bar codes, or even RFID will be used for both UTA electronic fare collection and ski resort passes and employee IDs.

6 Alternative Models for Transit and Financial Payment Linkages

As discussed in the previous sections, the issuance of contactless credit and debit cards has led to new initiatives where the transit and financial industries are collaborating to offer a new, common payment mechanism for transit customers. Sections 4 and 5 focused on the payment models currently being piloted in New York City and Utah. These pilots leverage the contactless payment cards currently in circulation in their present form and use the account number as a static credential. As described in Section 4, this leads to a model that allows existing contactless credit and debit cards to be used with no changes to the financial payments infrastructure, with a set of business and process challenges that the current pilots are working to address.

The new transit/financial initiatives that leverage common contactless technology are breaking new ground. The common use of contactless technology opens up an array of possibilities for transit agencies and financial payment providers to investigate and define multiple payment models, each with its own profile of benefits and challenges. This section provides a high-level description of two alternative models for transit/financial payment linkages. While the models discussed in this section have not been implemented as of the date of this white paper, the discussion is intended to illustrate that other options for transit and financial industry linkages could emerge. As with any new payment model, transit agencies and their financial partners would need to develop business models to determine the economic viability of the new approaches in their environments.

6.1 Issuance of a Co-Branded Multi-Application Payment Card

To date, the issuers launching contactless credit and debit payment cards have concentrated on providing cards and services with a limited functional scope in efforts to control costs, perceived risk, and the complexity of the initial consumer value proposition. As a result, cards have been issued with unused memory capacity and built-in security controls that eliminate write-back functions typical of the cards used in public transport.

The payment card industry continues to move forward with further evolution of its card strategies. These activities are yielding near-term products, technologies, and commercial constructs that would allow alternative strategies to those covered in Sections 4 and 5.

New card products are now entering the market that could accommodate discreet third-party application files with complete association certification of the contactless payment application. The third-party application files could be used for transit ticketing applications, as well as, retail loyalty and other applications.

In parallel with the financial industry's contactless initiatives, several major metropolitan areas have launched regional transit smart card systems and either have smart card systems operational or are in the final stages of implementation. With these programs, open standards have been developed for transit processing, regional brands have been established, and operational service regimes have been contracted or established.

A combined transit/financial payment card could take advantage of these developments. A standard transit application could be placed in unused card memory and could reside on the contactless credit or debit card. Cards carrying these files could be initialized prior to issuance (or in the field) with the appropriate keys and file format such that, once issued, cardholders could load transit fare products to the card. As long as the initialization and personalization process had been appropriately performed, the card issued would be ready for use in the transit system. The card could also support the secure write-back of trip-specific and historical data to allow the distributed processing of fare rules at the point of product use. Fare product processing would be performed in an offline manner as is the normal course of business in today's transit operations.

No additional changes, network connections, or certifications would be required. The transit back office system would continue to support maintenance, operations loading, and service functions required of the physical transit infrastructure.

The potential benefits of such an approach could include:

- The ability to leverage existing transit systems and national standards designed to process transit-specific transactions
- Potential rapid implementation of co-issuance strategies where advanced transit smart card systems are in place
- The ability to leverage brand recognition and association with operational transit brands through co-branding relationships
- The ability to segment transit users by targeting users of particular discounting programs (transfers, passes, multi-trip tickets)
- Similar operational/financial/policy models to those currently in place at transit operators
- Leverage of the existing financial infrastructure, with few additional services and/or little systems development required of the financial community and little change for transit agencies to deal with credit card fraud, terminal certification, and network compliance

The challenges with this approach are primarily commercial and operational in nature. These include:

- New relationships would need to be established between the financial sector and transit agencies, not in their capacity as merchants but in the development of partnerships to review the feasibility of issuance of multi-application cards. Back office processes also need to be put in place to allow the proper processing of personalization, initialization, and key control.
- Rules and conventions need to be established surrounding the placement and use of logos denoting the transit brand and presence of the application.
- Links need to be established between financial payment card customer support operations and those provided in support of the transit application.
- Operating policies need to be established governing hot-listing and disabling the transit application on a valid financial payment card if the card is lost or stolen.
- Guidelines need to be established on the management of cardholder usage data generated by the transit system.

This approach is being pursued by Transsys, Ltd. (Oyster Card's privatization contractor) in London which is working to define and develop a financial partnership that would include the issuance of a co-branded Oyster contactless payment card.

6.2 Payment with Mobile Devices

An additional emerging model for transit payment involves the use of mobile devices capable of communicating with the transit terminal infrastructure. Momentum is building rapidly behind a mobile device standard compatible with ISO/IEC 14443. Near Field Communications (NFC) was initially developed through collaboration between SONY Corporation and Philips Electronics. The standard is now embraced by a variety of technology providers including Inside Contactless, Nokia, Qualcomm, and others.

NFC-enabled devices can include mobile phones, laptops, personal digital assistants (PDAs) and other mobile computing platforms. Devices so enabled may carry smart cards (e.g., Subscriber Identity Modules in mobile phones) or may in and of themselves be intelligent devices capable of running applications. The financial payments industry is involved in a variety of trials where a "virtual" credit card is carried by the mobile device and the NFC interface is used to deliver the payment "card" data to the payment terminal. As the interface is compatible with ISO/IEC 14443,

conventional contactless payment terminals can be used as can those prevalent in the transit industry.

A successful trial was conducted on buses in Hanau, Germany where the “GoTo” application operating on MIFARE® smart card technology was enabled on Nokia NFC handsets. The trial successfully demonstrated the ability for a mobile phone to accomplish transit payment transactions by loading a transit data file to the phone and enabling the phone to appear to bus validators as “another smart card.”

Similarly, Tokyo’s JR East, in collaboration with NTT DoCoMo, issued the Suica transit application on NFC-enabled mobile phones. The application supports the identical functionality of the Suica smart card on the phone and provides additional user convenience features via the interactive display provided by the handset. This approach has enabled NTT DoCoMo to become part of the fulfillment channel for transit products as they can be delivered to the phone over the wireless network. This has opened up an additional revenue opportunity for the telecommunications operator.

Given that the phone is simply acting as a carrier and communicator of data to the transit terminal, either the static credential (virtual credit card) or transit application file model could be pursued by transit agencies who want to allow fare payment via mobile devices.

7 Conclusions

Sweeping changes in the payments landscape are now well underway, driven by an evolving business landscape, technology advancements and consumer expectations. Not since the advent of magnetic stripe payment cards has there been such a wholesale change in how payments are transacted at the retail level. Contactless payment devices provide not only speed and convenience to the consumer at the point of payment – whether one is in a transit system or retail environment – but they also provide a platform for developing new business models. From the merchant’s perspective, faster throughput at the counter or turnstile drives customer satisfaction and increases transaction volume. This efficiency helps the bottom line for both private and public sector entities alike. The goal of this Smart Card Alliance Transportation Council white paper was to examine in greater detail the new developments in the transit and financial payments marketplaces and assess if these new developments would forge stronger ties between the industries.

During development of this paper, several key opportunities and challenges were identified and examined and two ground-breaking pilot projects for the transit systems in New York City and Salt Lake City, Utah, were highlighted. Both of these projects will push the envelope for fare payment in public transport by directly accepting a contactless financial payment device at the subway turnstile or on board a bus at the farebox.

The greater than \$1 billion investment cycle in contactless smart card-based automatic fare collection systems in public transport is well chronicled, with many of those systems online today. However, most of these systems are closed systems unique to a single operator or regional consortium. Few transit operators have explored leveraging other payment options for their customers as these systems have largely been custom-designed, one-off systems. In contrast, the financial payments industry has coalesced around standard contactless smart card technology to assure full interoperability for *ExpressPay from American Express™*, *MasterCard PayPass™* and *Visa Contactless*. Over 32,000 merchant locations in the U.S. now accept contactless payments and over 13 million contactless financial payment cards and devices have been issued to consumers nationwide. Further, these consumers enjoy the freedom of full interoperability anywhere contactless payment is accepted. Transit operators want to offer as many payment options to their customers as possible and leveraging the financial payments industry infrastructure is key to opening up that set of payment options.

For transit agencies, there are several core elements for developing and deploying fare collection systems: transaction speed; fare policy (pricing) flexibility; tangible improvements in customer service; operating and business efficiencies; and data security and user privacy. There are striking parallels in the needs of the transit and financial payments industries and work is underway to narrow any gaps.

This Transportation Council white paper suggests that an alternative to today’s traditional transit payment model could be available without requiring major changes to the financial payments infrastructure. There are challenges, but they reside more in the realm of business strategy and operational processes than in the realm of technology solutions. As witnessed by the many proven and emerging technologies globally, there appear to be many ways to resolve the business and operating demands of the transit market. The key question is what combination of technical solutions can be structured to solve the needs of individual transit agencies for improved customer service and business performance technologies.

A suggestion is that an alternative established paradigm is found in the financial payments industry, both in terms of the technical solution and the business approach. As a preliminary conclusion, it appears that through a combination of financial industry rule changes and new business operation processes, the cost of processing individual transit payment transactions may become economically viable, so that processing no longer exceeds the cost of the fare product itself. Individual transit agencies and financial industry issuers and acquirers/processors would need to develop their own business models to determine the economic viability of this approach

in their environments. As the marketplace matures, further development is underway in the financial industry's approach to micropayments, including the evaluation of several small value payment models such as subscription-based payment, prepaid accounts, post-paid accounts through transaction aggregation, and direct payment processing over the standard payment networks.

With a market equivalent of 10 billion transactions annually, the U.S. public transit market is a one of the largest opportunities for micropayments. There are obvious challenges ahead in developing business models that leverage common technical standards between the financial payments and transit industries. However, once thought of as disparate industries, there is a clear nexus between them at many levels. In metaphoric terms, the two industries were pursuing payment platforms on parallel, but unconnected tracks; now the switches are being constructed to allow those critical connections to be made which will benefit customers and the markets that support them.

8 References and Resources

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9 Publication Acknowledgements

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About the Smart Card Alliance Transportation Council

The Transportation Council is one of several Smart Card Alliance Technology and Industry Councils, focused groups within the overall structure of the Alliance. These councils have been created to foster increased industry collaboration within a specified industry or market segment and produce tangible results, speeding smart card adoption and industry growth.

The Transportation Council is focused on promoting the adoption of interoperable contactless smart card payment systems for transit and other transportation services. Formed in association with the American Public Transportation Association (APTA), the Council is engaged in projects that support applications of smart card use. The overall goal of the Transportation Council is to help accelerate the deployment of standards-based smart card payment programs within the transportation industry.

The Transportation Council includes participants from across the smart card and transportation industry and is managed by a steering committee that includes a broad spectrum of industry leaders. Current Steering Committee members include: APTA, Booz Allen Hamilton, Cubic, ERG Group, Infineon Technologies, MTA/New York City Transit, Northrop Grumman Corporation, TriMet, U.S. Department of Transportation/Volpe Center, and WMATA.

Transportation Council participation is open to any Smart Card Alliance member who wishes to contribute to the Council projects. Additional information about the Transportation Council can be found at http://www.smartcardalliance.org/about_alliance/councils_tc.cfm.

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