

Smart Card Alliance

Transit and Retail Payment: Opportunities for Collaboration and Convergence

A Smart Card Alliance Report

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About the Smart Card Alliance

The Smart Card Alliance is the leading not-for-profit, multi-industry association of member firms working to accelerate the widespread acceptance of multiple applications for smart card technology. The Alliance membership includes leading companies in banking, financial services, computer, telecommunications, technology, health care, retail and entertainment industries, as well as a number of government agencies. 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. For more information, visit www.smartcardalliance.org.

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Executive Summary

Public Transportation Presents an Expanded Market Opportunity for Contactless Payment Systems

Ridership on public transportation in the United States is expanding, with significant investment underway to modernize and automate current fare collection systems. To further stimulate ridership, the federal government is providing incentives for employers to subsidize the use of public transportation by employees. This situation represents a unique opportunity to grow customer bases and revenue streams, not only for transit operators, but also for retailers and financial institutions.

Transit operators are moving away from multiple, non-integrated fare collection systems to systems that require only a single contactless smart farecard and allow travelers to access multiple modes of transportation, regardless of whether the transportation is administered by one agency or by multiple agencies within a region. This common infrastructure can provide efficiencies across operators and improve overall customer service.

Retailers and financial institutions also have an opportunity to partner with transit operators to provide the consumer with a payment card that can be used to pay for goods and services such as snacks, bridge tolls, parking fees, or food in restaurants or grocery stores located near public transit stations. Pilot projects in the United States and implementations of similar programs elsewhere indicate that consumers welcome such multi-application payment cards, perceiving them as convenient and cost-effective.

Contactless Smart Cards Are an Excellent Solution for Convergent Transit Retail Payment Applications

The success of contactless smart cards in automatic fare collection systems has already been demonstrated worldwide. Smart cards are also suitable for retail-financial applications, accommodating not only contactless interfaces but also the magnetic stripe interfaces more common to retail transactions in the United States. Contactless smart cards can therefore represent a viable solution for converging transit and retail-financial payment applications, providing a single card that meets the common requirements for both partners: ease of use, ability to replace cash, quick and accurate transactions, security, and data collection for improved market identification and customer service.

Convergent Transit-Retail Payment Applications Require Collaboration and Agreement on Technical, Business and Consumer Issues

Numerous scenarios are possible for implementing a combined transit and retail payment card – ranging from the use of a multi-technology card that incorporates a contactless chip for transit payment and traditional magnetic stripe for retail payment to a multi-application contactless smart card that supports both transit and retail payment. Each possible implementation involves different opportunities and challenges for the institutions issuing and accepting such a card.

Various business and technical issues are barriers to collaboration among transit and retail or financial partners, including selection and use of compatible standards, use of a common payment methodology, selection of compatible operating systems and security approaches, upgrade of retailer

point-of-sale terminals, potential changes in fraud exposure and liability, and development of programs to drive customer acceptance. Resolution of these issues is critical to developing contactless payment approaches that can be used across the transit and retail-financial industries.

Partnerships Can Leverage the Investment in Smart Card Infrastructure to Create Competitive Advantage

Contactless smart cards offer significant benefits for transit operators – both for improving customer service and operational efficiency and for opening up opportunities to collaborate with other industry sectors. The public transportation industry is at a crossroads as it considers strategies for the next advances in smart card-based fare payment. Should the industry leverage the technology developed in closed transit systems to enter the retail payment market, or should it focus efforts on becoming an application on a card issued by others?

Strategically, this is the time for transit operators to explore the potential for linkages to formerly disparate markets and develop partnerships with employers, financial service providers, retailers, and other transportation service providers. By leveraging the new contactless smart card infrastructure, transit operators and their partners can differentiate product and service offerings and create a strategic competitive advantage.

About This Report

This report was developed by the Smart Card Alliance to describe the current market opportunity for a combined transit and retail payment card. This report provides answers to commonly asked questions, such as

- What investment is being made in transit contactless smart card fare collection systems in the United States?
- How do automatic fare collection systems use smart cards now?
- What retail payment methods are commonly used in the United States and how are smart cards being used?
- What opportunities exist for payment cards to include both transit and retail or financial applications?
- What business and technical issues must be resolved to implement a convergent transit-retail payment card?
- What are the requirements that must be met for transit operators and retail-financial organizations to collaborate on a combination card?

Contactless Transit Payment

The face of public transportation in the United States is changing dramatically – for the better. As a result of significant federal and local investment, transit is “updating its look” in an effort to retain existing customers and attract new riders. To achieve this goal, transit systems across the country are expanding, acquiring new rolling stock, and upgrading to state-of-the-art, smart card-based fare collection systems.

Currently, programs to upgrade and modernize the fare collection infrastructure are under way in numerous urban areas, such as Boston, New York/New Jersey, Baltimore, Washington, D.C., Atlanta, Chicago, Minneapolis/Saint Paul, Los Angeles, San Diego, Seattle, Houston, and San Francisco. This infrastructure modernization, which represents what can be characterized as a “once in a generation” investment phenomenon, is part of the natural infrastructure replacement cycle. Fare collection systems first installed in the late 1970s and early 1980s have been reaching the end of their useful life for the last several years. As such, hundreds of millions of dollars have been invested in new fare collection infrastructure in the last several years.

First impressions are a key factor in the development and expansion of transit ridership, and fare collection systems are the first contact point for customers as they enter a transit system. Customers initially purchase or reload fare media and pass through a gate or other portal to catch a train or board a bus. Contactless smart card technology is the foundation for automatic fare collection (AFC) systems that meet customer requirements for quick ingress and egress, ease of use, and convenience. Contactless smart card technology is also the ideal platform to link multiple operating modes or multi-operator regional systems together under a seamless, cohesive regional program.

Public Transportation Overview

Public transportation provides a vital service throughout the country. According to the American Public Transportation Association (APTA), public transportation contributes to economic development, increased safety, energy conservation, a cleaner environment, less traffic congestion, higher real estate values, and more vibrant, livable communities, adding up to an improved quality of life for all citizens in the markets served.

Ridership on public transportation is on the rise. During the current decade, public transportation is expected to experience the sharpest growth in usage of any form of transportation. The last 6 years has seen a 22% increase in ridership, and ridership is currently at an all-time high. It is estimated that 14 million people move through public transportation systems throughout the United States daily. Based on the most recently available national statistics, Americans took an estimated 9.4 billion trips on public transportation in 2002, just slightly down from 2001, which had recorded the highest level of use in 40 years.

The face of public transportation takes many forms, including private and public buses, trolleybuses, van pools, jitneys, demand response services, heavy and light rail, commuter rail, automated guideway transit, inclined plane, cable cars, monorails, tramways, and ferryboats. More than half of all public transportation trips (54%) are trips to work, while 46% are trips to school, shopping, medical appointments, or entertainment facilities. In some cities with high congestion, public transportation has become the

transportation method of choice and is a cost-effective alternative to the automobile, the chief competition for transit providers.

Current Investment in Transit Systems

According to APTA, federal, state, and local expenditures on public transit systems in the United States totaled \$15.4 billion each year for the past 4 years. Further, in fiscal year 2002, the fifth year of the Transportation Equity Act for the 21st Century (TEA-21), the federal government invested approximately \$6.7 billion in public transportation.

One of the principal areas of capital investment is the fare collection system. Transit operators are currently switching from single purpose, dedicated fare collection systems to state-of-the-art smart card-based payment systems and networks.

One reason for the move to smart cards is the recognition among transit operators that transit must develop and implement programs that both retain existing riders and attract new riders. No longer is public transportation a “field of dreams” type market (“build it and they will come”). Transit customer service initiatives take many forms, including new AFC systems. In fact, the public transportation sector is adopting the approach of the more traditional retailer, focusing on the customer and deploying tools to improve the customer experience and expand the market.

Smart cards offer many benefits for transit system operators. For example, using smart card technology and data warehousing, operators can determine a rider’s origin and mode of travel. Transit providers therefore have a powerful tool for identifying the appropriate mode of service delivery and, through electronic links back to the customer, directing patrons to their optimal choice.

Transit Payment Systems Overview

The historical payment model for U.S. public transportation was that every operator used a unique payment system to collect fares. Little or no interoperability existed between operators, even in the same region, or between transportation modes of the same operator.

The historical situation is changing. Transit system operators are creating logical links among agencies in a region to support a common fare medium. Just as financial service providers have networked, interoperable credit and debit payment systems, transit is working toward the development of interoperable transit payment systems. The industry is simultaneously experiencing a once-in-a-generation investment in new technology and a wholesale shift in attitude, toward a shared infrastructure and use of the transit fare medium to pay for additional products and services. This shared infrastructure not only can improve efficiency and lower costs (from shared customer support and transaction clearing and settlement), but also can help to attract and retain new riders. Transit agencies are beginning to regard themselves as retailers of public transportation services and are viewing new AFC systems as financial management systems that will help them better serve their markets and grow the ridership base.

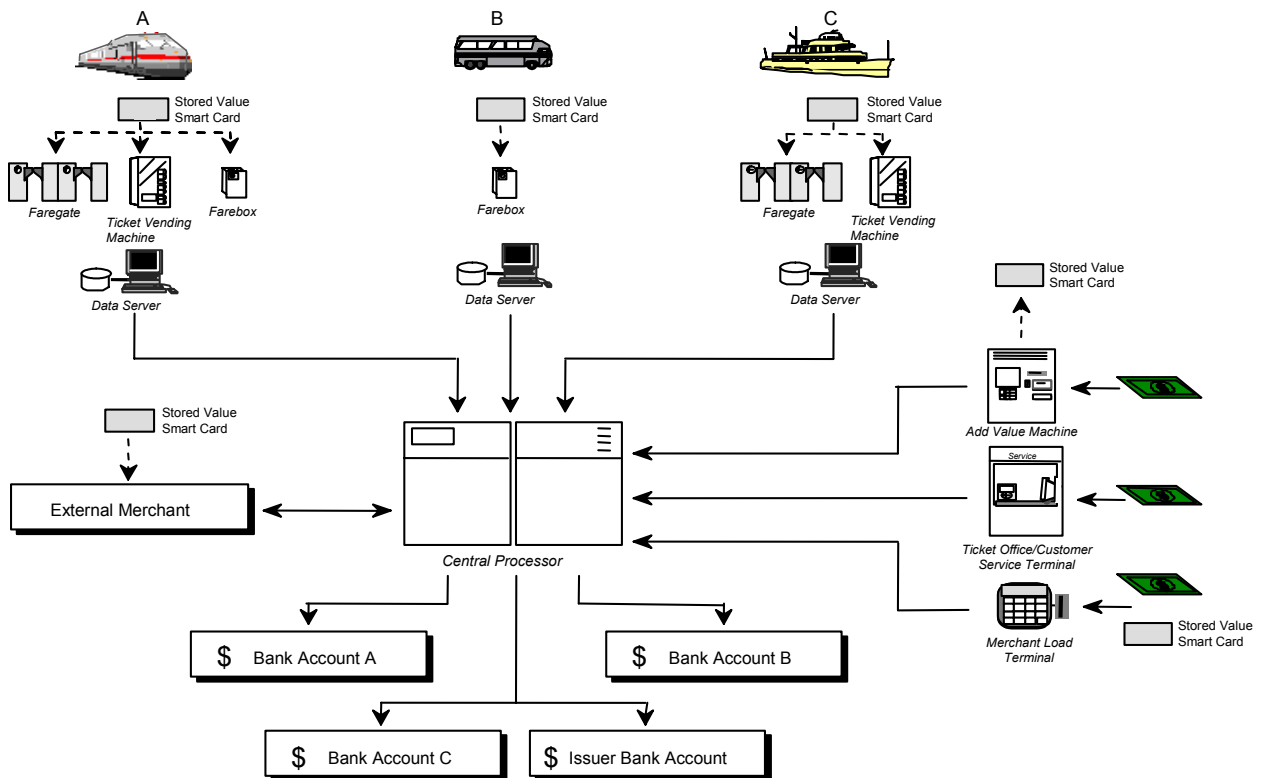
Mechanics for Transit Payments

Unlike traditional retail payments, transit payments are typically low-value transactions (micropayments) that are based on a stored value payment paradigm. Transit customers prepay a certain amount, either by presenting cash at transit station or retailer terminals or by using web-based tools to add value from preselected bank accounts. The prepaid amount is then stored in an “electronic purse” (epurse), either on the fare medium (e.g., a smart card) or in a central account on a host system that communicates with the fare medium. Both credit and debit cards are widely accepted in the transit industry for purchasing fare media and loading cards.

Transit epurse transactions resemble typical cash transactions with two important differences:

- The transmission between a local reader and a card completes the epurse transaction. In many cases, a transit transaction occurs offline (e.g., on a bus), in which case a central system is later updated by a batch file. In other cases, a virtually real-time data exchange is possible. In most cases, however, the transit system extracts payment at the time of use rather than accumulating charges and billing later. A system such as the Washington, D.C. system supports card-to-reader exchange but maintains full detail of each card’s history via a fully auditable transactional database.
- During the transaction, data elements describing past usage history are transmitted to permit the terminal to apply fare rules in calculating the specific fare due. These transactions must be made in real time by the terminal with total transaction time between 70 and 300 milliseconds.

Figure 1: Multi-Operator Transit Stored Value Smart Card Payment



In a multi-operator system, clearing functions can be handled by one of the participating operators or contracted to a third party. If sufficient internal resources/capabilities are not available at one of the operators, a central clearinghouse can be established. Figure 1 illustrates a smart card-based transit payment system architecture incorporating multiple operators, multiple modes and a central clearinghouse. Transaction data is collected and reconciled at the central system, and the corresponding fare revenue is deposited in the appropriate operator's account. If external merchants participate in the program, the clearinghouse can also clear funds for the merchants as well.

Transit Payment Requirements

New transit payment systems have a number of unique and critical requirements.

Fast transaction speed. The most important factor in a fare collection system is the speed of the payment transaction. Transaction speed has a significant impact on transit customer service, reducing the length of queues and speeding passengers through the system. The transportation industry needs to assure that any payment vehicle performs at speeds ranging from 70 to 300 milliseconds for the entire customer interface (i.e., using the fare medium at a gate, performing the transaction, and opening the gate). This speed is significantly faster than a typical debit/credit transaction at the point of-sale in a retail setting.

Transaction accuracy. Transit customers must be charged the correct fare for the trip. Transit payment fare schedules typically include a complex set of rules that take into account factors such as where and when the trip was taken and whether a transit pass was used. Transit operators consider an on-card e-purse as providing the most straightforward implementation of an interoperable payment system.

Data integrity and customer service. Transit payment systems must ensure data integrity and provide easy access to customer service (e.g., a Web site that allows customers to track transaction activity or reload value on the card).

Cash replacement. Public transit systems today still process relatively large amounts of currency. In a system such as the one in Washington, D.C., currency accounts for about 65% of daily bus receipts. Even in a highly mechanized environment, the cost of processing large volumes of currency is high. For most transit operators, cash handling is not a core interest and one that has significant potential for outsourcing.

System and processing costs. Because traditional financial and retail payment systems have not met the transit industry's requirements, transit agencies typically must invest in an entire payment system. If the payment system is operated by a third party, ongoing transaction processing costs also have a financial impact. In a multi-operator implementation, the economies of scale of the shared infrastructure can provide opportunities to save costs by consolidating multiple clearinghouses and customer service functions.

Transit Payment Systems and Smart Cards

Mass transit agencies worldwide have been using stored value prepaid cards for electronic ticketing since the 1970s. Through the late 1990s, this market steadily began transitioning from magnetic stripe technology to contactless smart cards. Today, virtually all transit fare payment systems in the delivery and procurement stages use contactless smart cards as the primary ticket medium. Major deployments are already operational in cities around the world, including Hong Kong, Seoul, Pusan, Washington D.C., and Shanghai. Figure 2 summarizes current and planned U.S. transit agency smart card programs.

Figure 2: Current and Planned U.S. Transit Smart Card Programs

Location/Lead Agency (Program Name)	Type of Program	Integrator/ Vendor	Status
Los Angeles/LACMTA (UFS)	Regional farecard	Cubic	Contract awarded; rollout planned in 2004
San Diego/MTDB	Regional farecard	Cubic	Contract awarded; rollout planned in 2005
San Francisco/MTC (TransLink)	Regional farecard	ERG	Pilot completed mid-2002; additional cards/equipment ordered mid-2003
Ventura County/VCTC	Regional farecard	ERG	Implemented 2002
Washington-Maryland- Virginia/WMATA (SmarTrip)	Regional farecard	Cubic/GFI/ ERG	In use on MetroRail, contract awarded for rest of region
Delaware/DeIDOT	Regional farecard	TBD	Under development
Miami-Ft. Lauderdale-Palm Beach/MDTA-Tri Rail (UAFC)	Regional farecard	Cubic (planned)	Board approval 2002; contract being negotiated
Orlando/Lynx (ORANGES)	Multi-modal integration	TTI, Ascom, Efkon	Under development
Atlanta/MARTA	Regional farecard	Cubic (planned)	Board approval 2002; award pending
Chicago/CTA (Chicago Card)	AFC option (also regional)	Cubic	Pilot completed, 100,000- card rollout in next phase
Boston/MBTA	AFC option	Scheidt & Bachmann	Contract awarded 2003; in design phase
Las Vegas/Monorail	New fare system (new service)	ERG	Contract awarded 2002; transit service to open 2004
Minneapolis–St. Paul/Metro Transit	New fare system	Cubic	Contract awarded; rollout planned late 2003 to early 2004
Newark/PANYNJ & NJT (SmartLink)	AFC option	Ascom/ASK	Pilot implemented 2001
NJ/PATH	AFC option	Cubic	Contract awarded 2002
Philadelphia/PATCO	New fare system	TBD	Under development
Houston/METRO	AFC upgrade	Cubic	Contract awarded 2002
Seattle-Puget Sound/KC Metro	Regional farecard	ERG	Contract awarded; rollout planned 2005

Source: TranSystems Corp. (formerly Multisystems), *Fare Policies, Structures and Technologies (Update) – Final Report*, Transportation Cooperative Research Program Project A-25, March 2003, with Smart Card Alliance member updates.

Benefits of Smart Cards for Transit Payment

Smart cards offer numerous benefits for transit fare payment transactions.

Increased customer convenience. A contactless smart card is easy to use. The traveler simply taps the card on the gate reader, with no specific card orientation required. Convenience helps generate ridership growth, enhances the cost-recovery ratio, and improves the transit agency's bottom line. Contactless smart cards support flexible fare arrangements for riders – for example, automatic discounts and multiple types of fares. When a contactless smart card can be used to pay for any mode of transportation (e.g., subway, bus, train), transfer between operators, perform fare addition and deduction on the fly, and take the guesswork out of paying fares, public transportation is more convenient to consumers and more competitive with the automobile for commuting and discretionary trips.

Efficient and convenient cash replacement. A smart card-based stored value payment system provides an easy-to-use alternative to cash. Consumers can conveniently load and replenish value for transit payment. The smart card also provides an opportunity for transit agencies to partner with the financial industry or with retailers to allow payment for non-transit purchases (e.g., at quick service restaurants or other locations that value fast and convenient consumer payment).

Lower operating costs. While the deployment of a contactless smart card-based system is capital intensive, such a system can lower operating costs. Contactless smart card readers are more reliable and require less maintenance than electromechanical readers. Contactless transit payment cards are more secure, have a longer life, and require fewer replacements than magnetic stripe cards during their life cycle. Contactless smart cards can also increase security and reduce fraud, reduce handling costs for fare media and/or cash, and provide cash flow advantages by shifting riders to prepaid fares.

More efficient revenue management activities. Depending on how the transit operator processes currency, reconciling reports from electronic transactions can be more efficient than processing cash.

Improved customer relationship management. Smart card-based fare collection systems provide transit operators with information about their customers' activities. Operators can use this data to understand customer behavior and serve customers more effectively. This value is maximized as transit payment systems are deployed across multiple operators in a region. For example, traveler origin and destination information can be used to better coordinate schedules between operators within a region.

Increased product differentiation. Smart cards can help transit operators differentiate their service offerings and offer innovative features to customers. Smart card-based AFC systems can encourage innovative strategic thinking, such as linking transit operators with non-transit partners, resulting in deployment of multi-application payment cards. More progressive transit systems are laying the groundwork required to shift from their traditional role as a card-issuing agency to the role of a card-accepting system (e.g., becoming a retailer of transit services and accepting a non-transit-issued payment card).

Efficient implementation of transit benefits programs. Beginning on January 1, 2002, employers were able to offer their employees up to \$100 per month in pretax commuting benefits. This figure represents an increase

from the \$65 previously allowed under the federal tax code and was made possible by the Transportation Equity Act for the 21st Century. Program participants can use the benefits to commute to work on buses, commuter and light-rail trains, subways, and vanpools.

The benefit provides an optimal opportunity to link private and public sector resources to improve the quality of transportation choices. Providing these choices is seen as a major tool for mitigating regional traffic congestion and urban sprawl.

Transit benefit programs can contribute a large fraction of transit operator revenue. A recently published report by the U.S. General Services Administration, Office of Governmentwide Policy, reported that the 58 agencies responding had spent approximately \$210 million on mass transit subsidies (passes, vouchers, or other cash reimbursements) for over 247,000 federal employees during the fiscal year 2002.¹

Administration of transit benefits programs with magnetic stripe fare media or paper vouchers is difficult. Smart card technology is being considered by organizations implementing transit benefits programs since smart cards can simplify program administration and deliver benefits electronically.

Early successes at the University of Washington in Seattle demonstrate the benefits of transit benefits programs for employees and employers alike. At the University, 82% of the students and 65% of the staff participate in the program (called U-Pass). Since the program began, the percentage of employees driving alone has decreased, while the use of alternative transportation has increased. Total campus ridership on the metropolitan transit system has grown by 68%, from 4.7 million to 7.8 million annual trips.² Other transit benefits programs are implemented in Washington, D.C., (WMATA MetroChek program) and New York (MTA TransitCenter program). The MetroChek program in Washington, D.C. generates approximately \$200 million in revenue from public and private sector employees.

Despite early successes (such as at the University of Washington), many employers do not take advantage of transit benefit options, even though the options save money, increase employee satisfaction, and help attract and retain employees. Recent research conducted by the Transit Cooperative Research Program is identifying both the factors that contribute to a successful benefits program and the barriers faced by employers wishing to implement programs. Some of the early findings indicate that employers located in urban areas with access to good transit service are more interested in benefit programs than suburban employers with less frequent service. Some of the lessons learned from employers are unexpected. For example, the main concern with implementing a transit benefits program was administrative time and expense. Even though benefits programs are often touted as easy to administer, deciding exactly what type of program to offer is a challenge.³

¹ "Federal Employees – Clean Air Incentives Act Report, Fiscal Year 2002," U.S. General Services Administration, Office of Governmentwide Policy, Office of Real Property, Washington, D.C. Of 70 federal agencies surveyed, 58 responded to the request for data on agency-sponsored programs to establish employee programs to promote commuting to work by mass transit systems.

² American Public Transportation Association (APTA) website, <http://www.apta.com>.

³ Lisa Ecola and Michael Grant, "Making Commuter Benefits Programs More Effective," ICF Consulting, *Passenger Transport*, January 7, 2002.

Summary

Smart cards offer significant benefits for transit operators – both for improving customer service and operational efficiency and for opening up opportunities to collaborate with other industry sectors. The public transportation industry is at a crossroads as it considers strategies for the next advances in smart card-based fare payment. Should the industry leverage the technology developed in closed transit systems to enter the retail micropayments market, or should it focus efforts on becoming an application on a card issued by others? Regardless of what decision is made, the early adopters of smart card technology have found that customers readily accept a change in the transit payment paradigm.

Extending Transit Payment: Example Implementations

Smart card-based transit payment systems are being used successfully worldwide. Among the organizations that have implemented transit smart cards and are extending the card to other applications are the following:

- Washington Metropolitan Area Transit Authority – SmarTrip®
- San Francisco Bay Area – TransLink®
- Ventura County Transit Smart Card
- Hong Kong Octopus Card
- London Oyster Card
- ORANGES Federal Demonstration Program

Washington Metropolitan Area Transit Authority - SmarTrip⁴

The Washington Metropolitan Area Transit Authority (WMATA) operates the second largest rail transit system and the fifth largest bus network in the United States. The Authority was created in 1967 by an interstate compact to plan, develop, build, finance and operate a balanced regional transportation system in the National Capital area. Construction of the Metrorail system began in 1969. Four area bus systems were acquired in 1973. The first phase of Metrorail began operation in 1976. The final leg of the original 103-mile rail network was completed in early 2001. Metrorail operates 83 stations.

Metrorail and Metrobus serve a population of 3.5 million within a 1,500 square mile area. The transit zone consists of the District of Columbia, the suburban Maryland counties of Montgomery and Prince George's, the Northern Virginia counties of Arlington, Fairfax and Loudoun, and the cities of Alexandria, Fairfax and Falls Church. Overall, 41 percent of those working in the center core, Washington and parts of Arlington County, use mass transit.

WMATA launched a contactless smart card called SmarTrip® in May 1999, with the broad objective of making transit travel easy, simple, and attractive for the customer. Just over four years later, more than 360,000 travelers have switched from paper to plastic, using smart cards to pay MetroRail system fares and Metro-operated parking lot fees. From the customer perspective, SmarTrip's success can be credited to the convenience of the card in terms of transaction speed, durability, reload capability, and ease of replacement if the card is lost, stolen, or damaged.

In the long term, WMATA is focusing on moving away from being a card-issuing organization to a card-accepting organization. In the short term, WMATA is the lead agency in promoting contactless smart cards as the payment tool for transit in the National Capital region. The largest functioning contactless transportation application in the U.S. is SmarTrip, which operates in metropolitan Washington, D.C. Since May 1999, sales at a limited number of facilities and an Internet site have remained steady at 6,000 to 8,000 cards per month. The only significant system enhancements have been the addition of card readers to all entry and exit gates in the MetroRail system (in March 2000) and of SmarTrip-equipped express exit gates at many of WMATA's parking facilities. The ability to use the card at any gate had a clear impact on card awareness and acceptance and on utility to the customer.

⁴ Source: WMATA, www.wmata.com

Contracts are in place throughout Washington, D.C., Northern Virginia, and the state of Maryland to populate 15 additional operators with SmarTrip-accepting infrastructure (provided by Cubic Transportation Systems, Inc. and ERG Group).

Since the introduction of the SmarTrip card, several pilot projects have been conducted to test the viability of multi-application cards that include transit fare payment. As part of an agreement with First Union National Bank in 2000, 1,000 cobranded cards were issued.⁵ The cards could be used both as a contactless transit payment card in the WMATA system and as a magnetic stripe debit card for banking transactions or for card reload for transit use. The cards were reissued to participants in 2002 and the pilot successfully concluded in August 2003.

Survey data gathered from cardholders indicated that the consolidation of functions on such a multi-application card was an attractive feature and would lead to increased use of the card. Satisfaction levels with the card were high for both the bank and the transit operator. There was some indication that the card could be a moderate draw for new customers. However, use levels for the card did not change for either the bank or the transit operator.⁶ While other financial institutions have shown interest in similar types of initiatives, no additional combination transit-banking cards have been developed.

WMATA has also entered into pilot projects with the U.S. General Services Administration and U.S. Department of Education for a cobranded combination transit-building access card. These projects were initiated in 2000 and 2002, respectively. They include approximately 2,000 cardholders between the two agencies and continue to operate today.⁷

WMATA customer surveys have found very high levels of acceptance and satisfaction with SmarTrip. The convenience, speed and utility of the SmarTrip card, coupled with WMATA's attention to customer service, has led to a 99% customer satisfaction index.

San Francisco Bay Area TransLink⁸

In 1999, the Metropolitan Transportation Commission (MTC) of the San Francisco Bay Area awarded a contract for a regional fare collection system that provides a single smart card to be used on every transit system in the area. This project, in which one card can be used on all modes of transportation with numerous transit providers, is the only project of its kind in the United States.

The Bay Area covers nine counties and 100 cities and has a population of over 6 million people living in an area of 7,000 square miles. On an average weekday, about 1.5 million rides are taken on public transportation. The area includes eight major transit operators and an additional 18 smaller operators.

Approximately 7,000 contactless smart cards, called TransLink cards, have been distributed for Phase 1 of the project. Phase 1 encompasses the six largest transit operators in the San Francisco Bay Area and involves certain buses, light, medium, and heavy rail, and ferries. The travel routes selected

⁵ Note: Before pilot implementation, First Union abandoned its smart card business line.

⁶ Steve McKinney, Enterprise Knowledge Research Group, February 2001.

⁷ Source: WMATA.

⁸ Source: ERG Group, www.erggroup.com.

for the Phase 1 implementation include transfer points between the six Phase 1 operators, to enable passengers to experience the benefits of an integrated fare collection system using the contactless smart card. This first phase has been operating since mid-2002. In June 2002, the entire San Francisco Muni Metro system was commissioned to accept the TransLink card. Phase 2 of the project commenced with an expansion of the program for two of the transit agencies. Work is also underway to integrate the smart card into existing Bay Area Rapid Transit (BART) system fare gates. Ultimately, up to 26 transit operators could participate in the program.

The Phase 1 system comprises over 1,500 pieces of equipment, including card processors, add-value machines, portable hand-held readers, ticket office terminals, and point-of-sale (POS) devices for use at retail outlets. Phase 2 of the project will involve almost 9,000 pieces of equipment. The add-value machines and selected card processors provide audio in two languages to assist the hearing impaired. Keys on the add-value machines and some card processors also include Braille, to assist the visually impaired.

The card being used complies with ISO/IEC standards for smart cards, including ISO/IEC 7816 and ISO/IEC 14443 Type B, and contains 4 KB of internal memory for data and application storage. The card is a dual-interface card, containing both contact and contactless interfaces for communicating with the card's microprocessor. For the transit system, the contactless interface is essential, providing ease of use and fast boarding times. The contact interface allows the card to be used for other applications, such as at ATMs or POS terminals, where a contact slot already exists or is more acceptable. For example, the third-party merchants that provide card reload facilities use off-the-shelf POS terminals with a built-in contact smart card slot.

A central clearinghouse and service bureau operates and manages the smart card system. This facility processes all transactions and settles payments on a daily basis between all participants in the program. Every 24 hours, transit operators receive payment for the day's activities and have access to detailed financial and operational reports, down to the individual transaction. The service bureau provides all cardholder, transit agency, and merchant support services. Cardholders can order and reload their smart cards using a variety of means, including telephone, mail, the Internet, and "autoload." Reload locations are located throughout the region at transit customer service locations, add value machines, and third-party merchants.

In June 2002, a focus group of TransLink Phase 1 pilot program participants was asked whether they would vote for TransLink to be launched region-wide if they were in charge of Bay Area transit. The participants in the focus group unanimously responded yes. Overall, the focus group was very positive about the TransLink program.

It was always envisioned that the smart farecard would be expanded to carry applications beyond the initial transit application. The first instance of this expansion is parking, with the smart card reader being integrated into new electronic parking meters to be installed in San Francisco in 2003 and 2004. The TransLink card can then be used to pay at parking meters throughout the city. The pilot program for the smart card-enabled parking meters started in early 2003.

Other applications being investigated are tolling (MTC also administers the tolls for the six major bridges in the region), taxis and retail payment.

Ventura County Transit Smart Card⁹

Ventura County, California, covers an area of 1,873 square miles with 43 miles of coastline. Public transportation serves the communities of Ventura, Oxnard, Simi Valley, Thousand Oaks, Moorpark, Camarillo, Santa Paula, and Fillmore. The population of Ventura County is 742,000, making the county the 12th most populous county in California. Within Ventura County, the Ventura County Transportation Commission manages six transit operators, with service that crosses into Santa Barbara and Los Angeles counties. The six operators are Ventura Intercity Service Transit Authority (VISTA), South Coast Area Transit (SCAT), Simi Valley Transit (SVT), Thousand Oaks Transit (TOT), Camarillo Area Transit (CAT), and Moorpark City Transit (MPT).

In 2000, the Ventura County Transportation Commission awarded a contract to the Motorola/ERG alliance to supply an AFC system using smart cards. The proposed system combined the smart card fare medium with automated passenger counting and Global Positioning System (GPS) location. In late 2001, the Motorola portion of the contract was transferred to ERG, with ERG assuming sole responsibility for the contract.

A total of 330 pieces of equipment have been installed and put into revenue service since January 2002. This equipment includes on-bus smart card readers, driver's consoles, and automated passenger counters. A network of 19 POS terminals allows cards to be purchased and reloaded. In addition, passes and epurse values can be loaded remotely. This capability allows reloading to occur automatically when the smart card is tagged on a bus.

A total of 10,000 cards have been supplied, and additional cards are in procurement for the current year. The cards in use are dual-interface smart cards with 4 KB of memory that comply with the ISO/IEC 7816 and ISO/IEC 14443 Type B standards.

In addition to collecting fares, the system includes automated passenger counting equipment that provides GPS location data and passenger entrance and exit counts.

The campus of California State University Channel Islands (CSUCI) has its own version of the smart card. The card is used for transit on the VCTC system and serves as a student identity badge for use on campus. The student smart cards carry two epurses—one for transit and one for use on campus. The campus epurse will be suitable for small transactions typical at a university, such as those at vending machines, photocopiers, cafeterias, and for computer services. Other potential uses of the card include on-campus parking and building access.

The student smart card allows university students to travel on the buses free of charge. The system records all bus rides taken by students using their cards. This record is used to reimburse the transit agencies, using funds provided by the university.

⁹ Source: ERG Group, www.erggroup.com.

Hong Kong Octopus Card¹⁰

The Octopus card was launched in 1997 as an electronic purse for public transportation in Hong Kong. The card's acceptance and popularity have since extended its use to nearby retailers for general retail payment.

Octopus cards were developed as an AFC scheme for Hong Kong's transit system. Over 9 million Octopus cards and 150,000 smart watches have been issued, and over 7 million transactions are recorded on a daily basis, for a daily transaction value of over HK\$50 million (about U.S. \$6.5 million).¹¹ This contactless smart card system currently includes over 100 service providers, including all of the major transit operators (bus, taxi, subway, train, tram, and ferry services). Because Hong Kong's main transit operators are all partners in the Octopus card, kiosks are widely available, making it easy for customers to check the balance on a card and reload it using cash or electronic payments. The use of the card has shortened queues at ticket barriers, because the card doesn't need to be removed from a bag or wallet – customers simply wave it past a scanner at a distance of several centimeters.

The first non-transit applications for the Octopus card allowed the card to be used for payment at photo booths located in the Mass Transit Railway (MTR) stations and pay phones operated by New World Telephone. After only 5 years, 25 percent of Octopus card transactions are unrelated to transit.¹² The card lets consumers make payments quickly and conveniently and is accepted by more than 160 merchants¹³, including 7-Eleven, Starbucks, Circle K convenience stores and McDonald's. Appendix B lists the transit and retail outlets that accept the Octopus card, as well as a number of access applications that take advantage of the card's capabilities.

In 2002, the Asia Pacific Smart Card Association reported that the Octopus card was being used by 95% of the "economically active population."¹⁴ Travelers have found that the card provides increased convenience, allowing them to pass through fare collection points 15 to 20% faster, according to Octopus card statistics. The scheme has succeeded because it offers real convenience to cardholders.

London Oyster Card¹⁵

In November 2002, TranSys, Transport for London, and London Underground began rolling out smart cards as part of a £1.2 billion world-class ticketing system designed to make travel in the capital faster, easier, and more convenient for London's commuters.

As of November 2002, 6,000 buses and 255 Tube stations were equipped to accept the new contactless cards, and a comprehensive data acquisition and control system is installed to support ongoing operations, revenue management, and reporting. After months of field testing, the card, called

¹⁰ "Contactless Payment and the Retail Point of Sale: Applications, Technologies and Transaction Models, Smart Card Alliance report, March 2003.

¹¹ Donald Davis, "The Contactless Wave," *Card Technology*, January 2003.

¹² "Contactless Smart Card Schemes in the Asia Pacific Region," Asia Pacific Smart Card Association report, August 2002.

¹³ *Ibid.*

¹⁴ *Ibid.*

¹⁵ Sources: Cubic Transportation Systems, Inc., www.cubic.com; "Easing travel in London's congested public transport network," *On the Move*, Volume 4, Issue 3, July 2002.

Oyster, was given to almost 80,000 Tube and bus staff in August 2002. In May 2003, a limited public introduction was made to 200 users. Success with each of these stages led to a June 2003 launch with cards available for sale through the Oyster card web site. Web support also includes online purchases of monthly, annual, and weekly passes which are electronically delivered to in-the-field Oyster cards via a directed auto-load and the fare processing device. In September 2003, ticket office sales were introduced. As of September 10, 2003, 26,000 cards had been issued. Fare policies will be introduced in January, providing incentives for Oyster card use on bus routes. It is anticipated that upon stabilized penetration more than 5 million cards will be issued in the greater London area. There are over 16,000 Oyster card-enabled terminals spread throughout the greater London area.

The credit card-sized Oyster cards need simply to be touched on the card readers on buses or at gates. For some travelers, the Oyster card will carry a period ticket, while others will use the card for a new PrePay ("pay-as-you-go") facility. The cards can currently be reloaded via the on-line facilities and at ticket offices. Functionality coming online includes load capability at ticket vending machines and via merchant terminals in a network of over 2,300 merchants called PASS agents.

The Oyster card is more secure than the previous magnetic stripe ticket and will speed travel by reducing the number of people paying cash to a bus driver and the number of trips travelers must make to the ticket office. The cards will also make it easier to switch between different modes of transportation. Ultimately they will operate across the network, including on trams and Docklands Light Railway as well as on buses and the Tube. Future plans include building a London-wide payment system that could be used for parking and other services.

ORANGES: Federal Demonstration Program to Advance the State-of-the-Art¹⁶

The Orlando Regional Alliance for Next Generation Electronic Payment Systems (ORANGES) is a Federal Transit Administration-sponsored test being conducted at a limited number of locations at the Central Florida Regional Transportation Authority (LYNX), the Orlando Orange County Expressway Authority, and the City of Orlando Parking Bureau. The participants in this test provide complementary services (multi-modal transit operations, toll roads, and other facilities, such as parking), constituting an environment that includes regional multi-modal applications suitable for electronic payment.

ORANGES is intended to develop an increased level of service, more value for customers, improved efficiency for shared "back office" functions, and the opportunity to provide innovative services. The long-term vision for the project is to move toward a multi-functional electronic payment system capable of seamless regional operation with shared payment infrastructure and operation. This system could be used for paying non-transportation transactions (for example, telephone service, TV use, gasoline, groceries, and other retail purchases). The use of a single, regional, electronic payment medium would enable participating agencies to offer a number of programs to encourage positive traveler behavior and enhance multi-modal transportation system performance. The potential exists for a number of other benefits to support improved customer service, system management, and marketing.

¹⁶ Source: U.S. Department of Transportation/Volpe Center, <http://www.volpe.dot.gov>.

Financial and Retail Payment in the United States

Traditional Credit and Debit Payment

Traditional credit and debit cards were used for 30.8% of total consumer payment transactions in the United States in 2001¹⁷, with credit and debit transactions increasing in 2002 by 6% and 12% respectively.¹⁸

In many regions of the world, the technology used by the banking industry for credit and debit cards is evolving from traditional magnetic stripe card technology to smart card technology. Rates of introduction vary, depending on business requirements for functionality or security. Smart cards provide a solution that delivers a high degree of security along with application flexibility and growth.

The U.S. financial smart card industry has made significant progress in the past 2 years, adding issuers, consumer smart card products, and smart card-ready POS terminal installations.¹⁹ Evolution of the U.S. payments infrastructure to support smart cards is a complex and costly process with participants needing to invest in new technology and processes. Although the process is proceeding more slowly in the United States than in international markets, the industry expects smart card adoption and acceptance to continue to grow, with implementation driven by business cases for new multi-application smart cards that benefit both merchants and consumers. Over 21 million financial smart cards are estimated to be in circulation in the United States as of the first quarter of 2003.

Although increasing consumer use of smart cards should drive retailers and processors to upgrade their magnetic stripe-based payment infrastructure to support smart card-based payment, this is not expected to be the case for pure payment applications in the U.S.

There are two major reasons why smart card-based credit and debit payment processes based on the EMV (Europay/MasterCard/Visa) specification (and mandated by the card associations) are being deployed in Europe, Latin America, and Asia: to reduce credit card fraud and telecommunications expenses. The majority of payment transactions in the United States, however, are authorized online, resulting in lower fraud rates than in other parts of the world. In addition, the card associations and U.S. issuers have developed sophisticated fraud detection tools and neural networks that identify fraud very effectively. Those same tools have not been deployed in other parts of the world. As a result, fraud by itself does not provide a sufficient business case for physical payment infrastructure stakeholders to invest in infrastructure upgrades. In addition, the United States also enjoys low telecommunications costs.

It is expected that the driving business case for smart card adoption in the United States will be based on revenue generation, new payment types, and value-added applications and programs.

¹⁷ "Consumer Payment Systems," *The Nilson Report*, Issue #777, December 2002.

¹⁸ Source: The Nilson Report.

¹⁹ See the Smart Card Alliance report, "Smart Cards and the Retail Payments Infrastructure: Status, Drivers and Directions," for additional discussion of the current state of the smart card payment infrastructure in the U.S.

Stored Value/Prepaid Payment Cards

Stored value or prepaid cards hold a monetary value for use by a cardholder. The value is stored either in an account held by the issuer or on the card.

Account-based stored value cards are issued by retailers, banks, or card associations and are an increasingly popular consumer payment mechanism. For example, sales of retailer gift cards increased 20% in 2002 to \$36 to \$38 billion, according to Bain & Co.²⁰ Visa and MasterCard now offer prepaid cards that member financial institutions issue directly to the consumer or through corporations to their employees (e.g., as payroll, gift or travel and entertainment cards). Consumers use these products to pay for purchases or access cash at ATMs, with the amount deducted from the prepaid balance. American Express also offers prepaid gift, travel funds and dining cards. The transaction process varies depending on the issuer. For example, gift cards can be processed like credit cards, while payroll card transactions typically require a personal identification number (PIN).

A card-based stored value card stores the monetary amount on the card. The amount is decremented by the terminal at the point-of-sale, without connecting to an issuer system. Information about all transactions is typically collected by the terminal and sent to the issuing bank as a batch process. Card-based stored value cards are efficient offline payment systems and are being used for transit payment. However, such cards are not implemented for general retail payment in the United States. Most deployments are closed, organization-specific systems, such as a campus or transit payment card.

Retail Contactless Payment Initiatives²¹

The latest trend in retail payment applications is contactless payment. Contactless payment systems are used successfully in Asia, Europe, and North America and offer a number of advantages to issuers, retailers, and consumers. Contactless payment allows issuers to penetrate the cash payment market, enjoy increased customer transaction volume, and improve customer retention and loyalty. Retailers realize benefits due to faster transaction times, increased revenue, improved operational efficiency, and lower operating costs. Consumers enjoy the convenience of hands-free payment, the ability to pay for multiple services using one device, and the security of not having to display a card for payment. Contactless payment applications are particularly attractive to retail segments where speed and convenience are essential (for example, quick service restaurants, gas stations, convenience stores, parking facilities, entertainment venues, and unstaffed vending locations).

Currently no single technology is used for contactless payment in the United States. Several technologies and approaches are vying to become the solution of choice for retailers. The contactless payment process also varies, depending on the solution, with some solutions using a traditional credit/debit card transaction and others implementing a unique closed-system approach. All cases require retailer POS infrastructure changes, which may include upgraded or new terminals that can communicate with contactless devices, a POS application that can format the payment message that is sent to the

²⁰ Lauri Gelsen, "The Value in Stored Value," *Banking Strategies*, July/August 2003

²¹ See the Smart Card Alliance report, "Contactless Payment and the Retail Point-of-sale: Applications, Technologies and Transaction Models," for a more detailed discussion of contactless retail payment in the U.S.

appropriate processor for authorization and settlement, and POS systems that can establish a connection with the payment processor.

Noteworthy contactless payment implementations in the United States include Speedpass, MasterCard PayPass, American Express ExpressPay, and E-ZPass.

Speedpass

Speedpass, introduced by ExxonMobil in 1997, was the first automated payment system to adopt radio frequency (RF)-based technology to help consumers make retail purchases. Today, over 6 million Speedpass customers frequent 7,500 Exxon- and Mobil-branded locations around the world. Motorists enrolled in Speedpass use a key fob, watch, or transponder affixed to their vehicle's rear window to communicate securely with a gas pump or POS terminal.

Speedpass as used at a gas pump is implemented as an account-based payment, authorized transaction by transaction. Consumers enroll in Speedpass and select a payment account that should be used for Speedpass transactions. The Speedpass system uses a low-frequency radio frequency identification (RFID) payment device that identifies the consumer and processes the transaction as a traditional credit- or debit-card transaction. The payment is collected in two steps. First, the transaction is authorized by the issuing bank. Then, when the amount of the transaction is known, it is charged to the consumer-selected credit or debit card.

Speedpass is recruiting key retailers in other sectors (such as grocery stores and fast food restaurants) to use the payment technology. Selected Stop & Shop supermarkets began using Speedpass in 2002 for payment, coupons, and a loyalty program. During the past 2 years, over 430 McDonald's locations in the Chicago area have begun accepting Speedpass.

MasterCard PayPass

MasterCard PayPass, announced in December 2002, eliminates the need for consumers to swipe their payment cards through a reader. Consumers tap their payment cards on a specially equipped merchant terminal that then transmits the payment details wirelessly. Chase, Citibank, and MBNA are working with MasterCard in a MasterCard PayPass trial in Orlando, Florida, where consumers can use the PayPass card at a variety of participating Orlando merchants. The MasterCard PayPass card uses a high-frequency RF payment device (based on the ISO/IEC 14443 standard) and also includes a magnetic stripe, allowing consumers to use it at any location that accepts MasterCard.

MasterCard PayPass is straightforward for retailers to implement. It uses standard credit card data for the payment transaction to leverage the existing magnetic stripe-based infrastructure. A special contactless module can be added to any magnetic stripe POS terminal. This module includes a contactless reader that collects the card information and passes it to the terminal, as if the information were from a regular magnetic stripe credit or debit card. From that point on, the transaction is treated as a traditional credit or debit card transaction.

American Express ExpressPay

American Express ExpressPay is a contactless payment device that is targeted at fast, low-value transactions. The card is half the size of a regular credit card. American Express is piloting ExpressPay in Phoenix, Arizona.

ExpressPay is implemented as an account-based payment, authorized transaction by transaction. Consumers enroll in ExpressPay and select a payment account that should be used for ExpressPay transactions. The ExpressPay system uses a high-frequency RF payment device (based on the ISO/IEC 14443 standard) that identifies the consumer and processes the transaction as a traditional credit or debit card transaction.

Consumers have two options for funding ExpressPay. ExpressPay Direct Link, which carries a daily spending limit of \$150, links to an American Express charge or credit card for payment. Individual charges are recorded directly on the card member's monthly billing statement for easy tracking. ExpressPay Pre-Loaded can be prepaid up to \$600 monthly, using any debit, charge, or major credit card (e.g., American Express, Visa, MasterCard, or Discover). The card can be reloaded automatically from the same payment source when the value goes below \$20. As with all American Express Card products, customers are not liable for any fraudulent ExpressPay charges.²²

Like MasterCard Paypass, American Express ExpressPay uses standard magnetic stripe data to leverage the existing payment infrastructure and avoid significant initial investment.

E-ZPass

The E-ZPassSM system, implemented in the northeastern United States, uses ultra-high-frequency RF transponders to pay highway tolls. With nearly 9 million transponders deployed, E-ZPass operates on more than 50 highways, tunnels, bridges in nine mid-Atlantic and northeastern states. Airport parking lots and a Long Island McDonald's also accept payment via the E-ZPass transponder.

E-ZPass is implemented as an account-based payment with set transaction limits. Consumers enroll in E-ZPass and prefund the E-ZPass account with a desired value using traditional payment methods. The E-ZPass payment device identifies the consumer to a central system in which the consumer's account and transaction limit information is stored. When an E-ZPass transaction is completed, the amount is deducted from the consumer's pre-funded account.

Why Contactless Technology for Retail Payment?

Contactless smart chip technology makes sense for retail payment for a variety of reasons. Contactless smart chip technology can be packaged in a variety of form factors to meet issuer, retailer and consumer requirements. Because cards are currently the dominant payment form factor, consumers are comfortable and familiar with using a card for payment. A chip-based contactless smart card that can be waved at a reader is even easier to use as a payment device than the traditional magnetic stripe payment card. Providing a payment device that is familiar and that can be used at a wide variety of retailers can increase card acceptance and usage. The additional security provided by the smart card may also provide greater comfort to consumers, who are increasingly aware of risks such as identity theft.

Datamonitor estimates that the use of contactless smart cards for all applications (e.g., payment, transit, access) will increase from approximately 100 million cards in 2002 to 280 million in 2006. Although conventional contact smart cards still represented more than 95 percent of the \$42.3

²² "American Express expands availability of new "contactless" payment product designed to make everyday purchases quick and easy," American Express press release, July 16, 2003.

billion smart card market in 2002, the market for contactless cards is growing at twice the rate of the market for contact smart cards.²³

Using contactless smart cards for payment applications has numerous benefits, including:

- Increased security.
- The flexibility to develop product partnerships and differentiators.
- Greater consumer convenience.
- Increased throughput for high-volume traffic.
- Potentially lower staffing costs
- Greater reliability and lower maintenance cost for reader terminals.
- Longer card life due to no mechanical wear from reader insertion.
- Longer life for unattended terminals.
- Support from all payment associations.
- Potential synergies with local transit agencies.
- Global industry standards to ensure the availability of the required product.

Visa International, MasterCard International, American Express, and JCB have all launched programs based on contactless smart card technology. The announcement of MasterCard's PayPass trial stated that 63% of the consumers surveyed said they would "definitely" or "probably" use PayPass if their bank offered it to them.²⁴ Achieving such percentages would clearly indicate that the contactless smart card provides a desirable retail payment option.

Conclusions

Retail payment in the United States typically uses the credit and debit networks, whether using magnetic stripe credit and debit cards or prepaid cards issued by MasterCard and Visa member financial institutions or American Express. Contactless retail payment is emerging; however, mainstream financial implementations of contactless retail payment are still in pilot.

While the retail and transit payment markets have historically used different technologies and processes (as shown in Figure 5), there are several technologies and trends that could help to drive convergence. For example, a multi-technology payment card that includes both a magnetic stripe for financial payment and contactless chip for transit payment could provide a straightforward step to a combined payment vehicle. Alternatively, contactless payment successes may motivate retailers to upgrade POS systems to accept contactless payment devices and help to accelerate the deployments of contactless payment in mainstream retail segments. A contactless payment card supporting both transit payment and retail payment could serve both markets.

With investments in new payment technology being made in both the transit and retail sectors, opportunities for collaboration are emerging that can deliver significant advantages to all parties in the payment transaction.

²³ "Access Will Overtake Transit as Contactless Card Application," *Card Technology*, October 2002, p. 25.

²⁴ "New MasterCard PayPass Utilizes Contactless Payment Technology," MasterCard press release, December 12, 2002.

Figure 5: Comparison of Financial Bank Card and Transit Payment

	Bank Payment Card	Transit Payment Card
Issuer	Financial institutions	Transit agencies
Economics	Interchange fees Interest Other fees	Increased ridership Float Fees (for use outside of metro)
Risk	Credit Fraud	Fraud
Market Participants	Acquirer (represents merchant) Issuers (represents cardholders) Associations (facilitates communication between two)	Operators Processor
Settlement – Consumer	1 - 48 days	Instantaneous
Settlement – Merchant	1 - 2 days	1 day
Point-of-Sale Network	In place - open	Needs to be deployed - closed
Payment Model	Credit or debit payment with online authorization	Prepaid stored value payment, with many offline locations (e.g., buses)
Dispute Processing	Established chargeback process rules/reason codes	Related to lost, damaged or stolen cards or incorrect fares or loads
Consumer Reporting	Monthly statements	Optional – prefer online activity or telequeries
Regulatory	Regulation E (debit) Regulation Z (credit) Fair Credit Reporting Act	Agency governing board
Authorization	Centralized - Issuer	Decentralized – card and terminal
Reconciliation	Integrated with acquirer	Required in multi-transit operator environments
Merchant Reporting	Monthly statements	Will require account statements as card expands outside of transit-only implementations
Card	Magnetic stripe Smart card (emerging) Contactless (emerging)	Contactless
Card Management	Well-defined	Emerging
Transaction Security	PIN or signature	None
Fraud Exposure	Counterfeit	Limited – card can be deactivated and rendered useless

Opportunities for Transit and Retail Payment Convergence

The time is right to explore opportunities for transit and retail payment convergence. Numerous scenarios are possible for implementing a combined transit and retail payment card – ranging from the use of a multi-technology card that incorporates a contactless chip for transit payment and traditional magnetic stripe for retail payment to a multi-application contactless smart card that supports both transit and retail payment. Each possible implementation involves different opportunities and challenges for the institutions issuing and accepting such a card.

As transit operators look for opportunities to extend contactless smart card payment systems, retailers and service providers for whom speed and convenience of payment are essential represent a logical set of partners.

Potential partners include:

- Other regional transit service providers.
- Municipal service providers (e.g., metered or garage parking).
- Retailers in the vicinity of transit stations, especially those who value fast transactions (e.g., quick service restaurants, gas stations, convenience stores, unstaffed vending locations).
- Entertainment venues in the vicinity of transit stations (e.g., theaters, hotels, convention centers).
- Federal, state, and local government agencies.
- Major employers and employment centers, who can add transit payment as an application on an employee ID card.
- Employers, retailers, and financial institutions implementing transit benefits programs.

Transit and Retail Payment Convergence Scenarios

The scenarios in this section describe four examples of a combined transit and retail payment card with different business models, issuance processes, and benefits. The scenarios are intended to illustrate a range of implementations; they do not include all possible scenarios.

All four scenarios assume that a contactless smart card is used for transit payment to replace cash for a single-journey transit ride. The goal of each scenario is to allow the consumer to use the same card for retail purchases and transit purchases. The table that follows each scenario summarizes the advantages and disadvantages of that scenario.

Scenario 1: Contactless transit payment card with magnetic stripe for retail payment

This scenario is similar to the implementation of the cobranded WMATA/First Union card (see page 15).²⁵ The bank issues a payment card to consumers that includes a magnetic stripe for retail credit or debit payment and a contactless chip for transit payment (using a transit e purse). Consumers can load the transit e purse by using the magnetic stripe at specially equipped transit terminals. To the partner bank, the transit agency is the same as any other retailer.

²⁵ This approach is also being used in Japan where a cobranded magnetic stripe-based Visa card is issued with a contactless prepaid payment application for JR-Line transit.

This type of implementation allows the most straightforward collaboration and implementation but offers retailers and consumers no new payment benefits.

	Advantages	Disadvantages
Consumer	<ul style="list-style-type: none"> • Easy transit payment • Single card for transit and retail payments 	<ul style="list-style-type: none"> • No contactless retail payment advantages
Retailer	<ul style="list-style-type: none"> • Potential for increased sales from increased usage of common card • Existing retail POS infrastructure used 	<ul style="list-style-type: none"> • No contactless retail payment advantages
Transit Agency	<ul style="list-style-type: none"> • Straightforward implementation and collaboration • Existing transit infrastructure used • Fast, efficient cash replacement • Potential to link to EBT transfers • Potential for favorable debit transaction fees for epurse load • Co-branding 	<ul style="list-style-type: none"> • Implementation of personalization process
Bank	<ul style="list-style-type: none"> • Straightforward implementation and collaboration • Existing financial infrastructure used • Co-branding 	<ul style="list-style-type: none"> • Implementation of personalization process

Scenario 2: Contactless transit-issued payment card with one or more epurses

This scenario is similar to the implementation of the Hong Kong Octopus card (see page 19). The transit agency issues a payment card to consumers that contains one or more epurses to be used for both transit and retail payment. The consumer loads the epurse(s) over the Internet or through specially equipped terminals and uses the card at transit stations and with participating retailers.

	Advantages	Disadvantages
Consumer	<ul style="list-style-type: none"> • Easy transit payment • Single card for transit and retail payment • Speed and convenience of contactless retail payment • Perceived decrease in cost for purchases • Easier payment than cash 	<ul style="list-style-type: none"> • Education on new payment process for retail payment (using epurse)
Retailer	<ul style="list-style-type: none"> • Potential for increased sales from increased use of card and increased transaction value • Faster transactions • Savings from cash replacement 	<ul style="list-style-type: none"> • Changes to retail payment infrastructure
Transit Agency	<ul style="list-style-type: none"> • Increased ridership • Increased number of transactions • Potential for increased revenue from retail transaction fees • Faster transactions • Cash replacement 	<ul style="list-style-type: none"> • Separation or isolation of any transit subsidies from retail purchases • Possible regulation restrictions to adoption of this model • Change to transit infrastructure to track values and reimburse merchant
Bank	<ul style="list-style-type: none"> • Not applicable 	<ul style="list-style-type: none"> • Disintermediation from contactless payment transactions

Scenario 3: Bank-issued payment card with contactless credit or debit card payment and contactless transit payment epurse

In this scenario, a bank issues a single contactless payment card that consumers can use both for credit or debit card payment at retailers (for example, using a payment mechanism similar to MasterCard PayPass or American Express ExpressPay) and for epurse payment at transit stations. The card may have one or two chips, with transit payment being a separate application. The consumer loads the transit epurse over the Internet or at specially equipped terminals. Separate transit and financial payment infrastructures process the payments, with the POS terminal reading the chip and routing the payment correctly. The card may also have a magnetic stripe to allow payment at existing retail locations.

	Advantages	Disadvantages
Consumer	<ul style="list-style-type: none"> • High consumer convenience • Single card for transit and retail payment • Speed and convenience of contactless retail payment • Perceived decrease in cost for purchases • Easier payment than cash 	
Retailer	<ul style="list-style-type: none"> • Potential for increased sales from increased use of cards and increased transaction value • Faster transactions • Savings from cash replacement 	<ul style="list-style-type: none"> • Changes to retail payment infrastructure (which may be minor if payment cards are already supported)
Transit Agency	<ul style="list-style-type: none"> • Increased ridership • Decreased cash handling • Card issuance cost savings 	<ul style="list-style-type: none"> • Loading process (authorization and load) • Credit card fees (load, deduct) • Change in fraud exposure and risk allocation • Personalization infrastructure connection to bank
Bank	<ul style="list-style-type: none"> • Cash replacement and increase in credit card transactions 	<ul style="list-style-type: none"> • Personalization infrastructure connection to transit agency • Change in fraud exposure and risk allocation

Scenario 4: Bank- or retailer-issued payment card with retail epurse and contactless transit payment epurse

In this scenario, a bank or retailer issues a single contactless payment card that includes both a retail epurse and a transit epurse (i.e., two stored-value epurses). The consumer loads value over the Internet or at specially equipped terminals and uses the card at transit stations and with participating retailers.

	Advantages	Disadvantages
Consumer	<ul style="list-style-type: none"> • High consumer convenience • Single card for transit and retail payment • Speed and convenience of contactless retail payment • Perceived decrease in cost for purchases • Easier payment than cash 	<ul style="list-style-type: none"> • Education on new payment process for retail payment (using e purse) • Liability if card is lost
Retailer	<ul style="list-style-type: none"> • Potential for increased sales from increased use of card and increased transaction value • Faster transactions • Savings from cash replacement 	<ul style="list-style-type: none"> • Changes to retail payment infrastructure • New fees and process for reimbursement • No implementations of contactless retail epurses in United States
Transit Agency	<ul style="list-style-type: none"> • Increased ridership • Decreased cash handling • Card issuance cost savings • Increased service efficiencies 	<ul style="list-style-type: none"> • Personalization infrastructure connection to bank
Bank	<ul style="list-style-type: none"> • Cash replacement and increase in electronic transactions 	<ul style="list-style-type: none"> • Personalization infrastructure connection to transit agency • Change in fraud exposure and risk allocation • No implementations of contactless retail epurses in United States

Each scenario presents a different set of opportunities and challenges for the parties involved in the payment transaction, but in all scenarios the consumer benefits are clear. The success of a transit-retail collaboration may depend on taking a series of incremental steps leading to a common payment card. The numerous technical and business differences between transit and retail payments (discussed in the next section) also need to be considered.

Transit agencies should consider the following factors when evaluating partner opportunities:

- Is there a critical mass of consumers? Initial opportunities are most likely greater in major metropolitan areas, with subsequent opportunities in transit corridors and regions.
- What is the potential volume of transit and retail transactions?
- What standards-based technology should be deployed? Where is the technology not standardized?
- What is the “chip zone” surrounding the transit station (the area in the immediate vicinity of the transit station where fast, convenient payment would be most attractive to consumers)? What retailers are located in this zone?
- What steps are required to implement a combined transit/retail payment card? What incremental steps can be taken to simplify collaboration?

In the near term, the transit, retail, and financial industries can combine independent technologies on a common card to offer additional consumer utility and allow retail or card issuers to differentiate their products. The existing transit or financial infrastructure accommodates transactions, and each party remains liable for application functions and risks. This step can be an excellent starting point for more extensive collaboration in the future.

Key Issues and Considerations for Transit/Retail Payment Convergence

While there are many benefits to transit-retail payment convergence, the two markets have distinct differences. Transit and retail have very different payment processes, use different payment technologies, and involve unique business requirements. All of these issues must be considered carefully if transit operators and financial institutions are to partner successfully.

Technical Issues

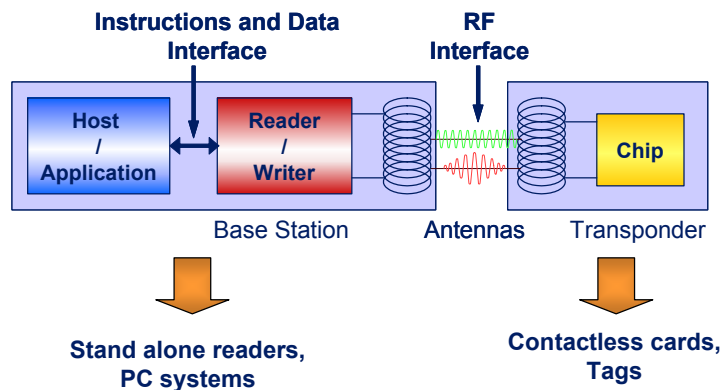
Certain technical issues must be addressed to enable transit agencies and financial institutions to deploy a multi-application transit-retail smart card.

Standards

If transit and retail-financial payment schemes are to converge, the involved organizations must commit to deploying and adhering to established smart card technology standards. The choice of standard would depend on which technologies are being used to implement a combined transit-retail payment card.

For example, consider a combined card that uses contactless technology for both transit and retail payment. Figure 7 illustrates the principles of a contactless smart card system. The card used for a payment application is most frequently an RF device that complies to the ISO/IEC 14443 standard for proximity cards.²⁶ ISO/IEC 14443 governs contactless cards operating at a range of 10 centimeters. The standard defines the card's physical characteristics, RF power and signal interfaces, initialization, and anticollision and transmission protocols. A compliant card incorporates an integrated circuit (either a memory or microcontroller chip), an input/output coil, and a tuning capacitor. The chip is powered inductively when it is presented within the operational range of the reader. Data transfer is conducted at 13.56 Mhz, with an ISO/IEC-specified data rate of 106 kilobits per second. (Faster data rates are available.)

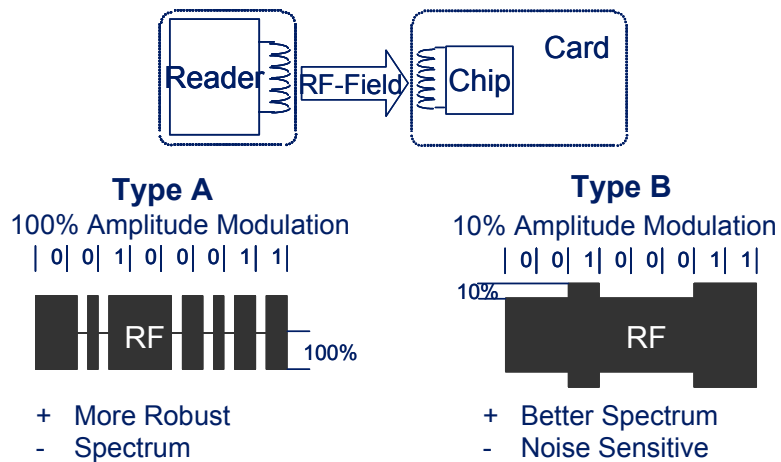
Figure 7: Principles of a Contactless Smart Card System



²⁶ See the Smart Card Alliance report, "Contactless Technologies for Secure Physical Access: Technology and Standards Choices," for a more detailed discussion of ISO/IEC 14443-compliant smart cards.

ISO/IEC 14443 currently recognizes two standard communication signal interfaces, Type A and Type B. Figure 8 illustrates the differences between Type A and Type B cards. The differences include the modulation of the magnetic field used for coupling, the coding format, and the anticollision method (i.e., how the cards and readers respond when multiple cards respond simultaneously to a reader's request for data). When standardization efforts began in 1994, Type A and Type B cards had a slightly different application focus. Currently, technological advances have removed this application differentiation. Because both are included in the final version of the ISO/IEC 14443 standard, the widest possible vendor base is able to offer standardized contactless technology. Card issuers typically support either Type A or Type B. All ISO/IEC 14443-compliant readers support both Types A and B.

Figure 8: Differences Between ISO/IEC 14443 Type A and Type B



Neither the transit nor the financial industry has settled on the use of a single set of standards for using contactless smart cards for payment. Approaches have differed both at the card level (i.e., whether to base the card on ISO/IEC 14443) and at the transaction level (i.e., how the payment transaction is executed).

Historically, different transit operators used different technologies and systems. There is currently a strong effort within the industry to standardize payment so that new AFC systems can be used by multiple transit operators within a region or corridor. The industry is also coordinating with other industries, especially the financial sector, to ensure that compatible standards are selected or developed.

In an effort to stimulate standardization, APTA established a Universal Transit Farecard Standards (UTFS) Program in the spring of 2002. This program is intended to help the transit community address business and operational issues and understand the technical interfaces associated with integrating independent revenue collection systems into a regional transportation payments system. The UTFS program brings together the expertise of the private sector and the needs of public transportation agencies to realize this objective in a manageable and cost-effective manner that supports movement to an open architecture in fare collection systems, provides decision-makers with more competitive procurement options, uses

advanced technologies and forges new partnerships to increase operational efficiency while improving access and convenience for patrons.

The UTFS mission is to develop a series of documents that provide industry guidance for the creation of an open architecture payment environment that promotes greater access and convenience to the public transportation network and enables integration of independent payment systems. The guiding principles are as follows:

- Promote economies of scale for agencies and enable more competitive procurement.
- Provide a platform to support agency independence and vendor neutrality.
- Strive for a platform that maximizes compatibility with current automated payment systems, thereby reducing integration costs for agencies with legacy systems.
- Strive for an open architecture for hardware and software that uses commercially available products.
- Foster development of a multi-modal and multi-application environment that includes non-transportation applications.
- Provide information for making informed decisions and developing partnership strategies.

The UTFS program has defined a working group structure to specify the technical aspects of fare collection systems. The working groups are composed of individuals from throughout the transit industry, including representatives from agencies, system integrators, financial institutions, payment processors, consultants, and manufacturers (chip, card and device). The technical work groups will address the end-to-end solution, including the card, card-reader interface, data elements, back-end functionality, clearing and settlement, and security.

The anticipated completion date for UTFS program activities is the spring of 2005. Although the standards effort is not yet complete, the transit industry is already moving toward ISO/IEC 14443 Type A or B for new smart card implementations²⁷ and is working closely with the financial sector to ensure compatible payment approaches.

The financial industry in the United States is supporting contactless payment solutions based on ISO/IEC 14443. Visa has endorsed a global payment specification for contactless cards based on ISO/IEC 14443 and EMV, and a number of trials in Asia are planned or already under way.²⁸ MasterCard International has implemented contactless technology based on ISO/IEC 14443 Type A or B in the PayPass pilot in Orlando, Florida.²⁹ American Express ExpressPay is using ISO/IEC 14443 Type B in its pilot in Phoenix, Arizona.³⁰

The selection and use of compatible standards are critical to accelerating the use of contactless payment among transit operators and across the transit

²⁷ For example, the San Francisco Bay Area, Ventura County, Minneapolis/St. Paul and Boston AFC systems will use contactless smart cards based on ISO/IEC 14443.

²⁸ John Frank, "Visa selects ISO 14443 as its standard for global contactless payments," *ContactlessNews*, December 2002.

²⁹ MasterCard, op. cit.

³⁰ "Amex Tests Wave 'N' Go Payment," *Card Technology News Bulletin*, March 6, 2003.

and retail-financial industries. Products and applications that comply with established standards will enable the partners to deploy interoperable cards economically. The benefits to all involved organizations include availability of technologies with limited royalties, dual sourcing of products and applications, interoperability among card deployments, and greater flexibility to select “best of breed” within technology and application product offerings.

Payment Methodology

The selection of compatible payment methodologies is both a technical and business issue.

Retail payment transactions currently use the existing credit and debit networks, with magnetic stripe cards, EMV-based contact smart cards (outside of the United States), or ISO/IEC 14443-based contactless smart cards (in U.S. pilots). Account-based stored value or prepaid retail payment cards have been implemented using the magnetic stripe card and the credit/debit infrastructure.

The transit industry is developing a payment infrastructure that will capture data, transmit information, and perhaps ultimately exchange data between participants. Development activity centers on implementing a stored value contactless smart card payment system, using either a central account or a card-based electronic purse. The consumer funds the stored value account with cash or with a credit or debit card transaction.

The transit industry is working with the government and financial sectors to develop compatible payment approaches. The likely first step will be to incorporate each sector’s needs into a multi-technology and/or multi-application smart card on which the industry-unique payment applications are managed separately. The WMATA/First Union card described on page 15 is a good example of this approach. The transit industry is working to assure that the transportation sector’s needs are recognized by other partners seeking to provide multi-application utility to their cards. To some extent, transit applications are also beginning to set expectations for card performance.

Operating Systems

The selection of an appropriate operating system can be critical to card success. Choosing the correct operating system increases the functionality of the card by supporting reconfiguration of applications after the card is issued. In many instances, an issuing organization initially deploys a card with a single application; as card acceptance grows and market opportunities arise, the issuer can increase the functionality of the card by adding new applications. Applications can be added efficiently when an operating system supports secure dynamic loading and unloading of applications.

An open operating system allows any card deployment to migrate to more functionality as market and consumer acceptance increase. By choosing an open operating system, collaborating organizations will also be able to multi-source the smart card controller, operating system, and applications. The two most standardized operating systems in the smart card industry are Java Card™ and MULTOS.³¹

Java Card technology enables smart cards (and other devices with limited memory) to run small applications, called applets, that use Java technology.

³¹ For more information, see the Java Card Forum, www.javacardforum.org and MAOSCO, www.multos.com.

This technology offers platform independence, the ability to store and update multiple applications, and compatibility with current smart card standards. Java Card technology allows new applications and services to be built, tested, and deployed, rapidly and securely. This capability reduces development costs, adds product differentiation, and enhances value for customers. Almost any type of smart card can be fitted with Java Card technology, including the SIM cards used in cell phones on most second- and third-generation wireless networks, financial cards providing both online and offline transactions, government ID cards, and cards granting logical and physical access to enterprise resources.³²

MULTOS is an open standard multi-application smart card operating system governed by the members of the MAOSCO consortium – a group of leading silicon chip, smart card manufacturing and issuing organizations worldwide. MULTOS enables the development of smart card applications in widely known languages such as C and Java. MULTOS provides a high level of operating system security (ITSEC E6 High) to protect personal data. MULTOS chips from multiple silicon providers are designed to provide end-to-end interoperability – application execution, personalization, post-issuance, and implementation of security-enforcing functions. MULTOS has a flexible and secure application load and delete mechanism that allows the card issuer to add new applications to smart cards in the field.

The Global Platform specifications also provide standards for an open smart card infrastructure that enables service providers from many industries to deploy and manage multiple applications for their customers through a variety of devices.³³

Security

Sharing different applications on the same card demands an integral and common approach to security. The approach must address all elements of the infrastructure – the hardware, software, and front- and back-end systems. For a card to be a successful multi-application and multi-issuer card, each involved party must have confidence that the system can maintain the integrity of its application and the issuer's infrastructure for processing transactions.

Security is a multi-dimensional target. It must provide for secure authentication and protect the confidentiality and integrity of data, while allowing for data to be available for its intended use.

The chip card integrated circuit (IC) should adhere to the current protection profile as established by the various international standards bodies. The chip card IC should protect the data against physical hardware, electrical, and analytical attacks. Hardware attacks occur when the aim of the attack is an attempt to investigate the program or the secret data by analyzing the physical memories (e.g., by using reverse engineering). Electrical attacks attempt to read the stored data or program instructions during operation. These attacks can be done by probing the chip, forcing errors by voltage and frequency irregularities. Analytical attacks are based on the power consumption of the chip. These attacks are mainly directed against microcontrollers. The most common methods of these attacks are Simple Power Analysis (SPA) and Differential Power Analysis (DPA)

³² Source: Sun Microsystems. Portions copyright © 2003 Sun Microsystems, Inc.

³³ For more information, see www.globalplatform.org.

Interfaces

The transit environment requires the deployment of contactless interface cards. The payment process must be quick and easy. However, a multi-application card may need to handle applications that have either contact or contactless smart card interfaces. Issuing organizations can accommodate these interfaces by issuing cards with multiple interfaces, either two chips or a dual-interface microcontroller.

Two-Chip Cards. Some cards implement both contactless and contact interfaces by incorporating two chips in one card. One chip has a contact base interface to support applications (such as logical access and retail payment transactions) that are accessed by means of the contact plate on the card. The other chip supports applications that are accessed using the RF interface. The RF interface can be an ISO/IEC 14443 Type A or Type B interface. Application separation is assured by the presence of two chips. However, using a two-chip card could neutralize some potential benefits of combining transit and retail-financial payment applications. The cost of embedding two chips in plastic and the logistics of the production of such a card are additional factors.

Dual-Interface Microcontrollers. A multiple interface card can use a single dual-interface chip for both contact and contactless interfaces. The dual-interface chip allows a card to host multiple applications with secure memory management capabilities designed into the chip to assure application integrity. The memory required for the different contact or contactless applications can be allocated as needed. With the increased interest in contactless transactions, an application that is currently contact-based may migrate to a contactless interface in the future. This technology reduces the need to reissue cards when applications are upgraded.

Point-of-Sale Terminals

Since only magnetic stripe-based transactions are supported in the majority of retail point-of-sale (POS) terminals in the U.S., POS systems may need to be upgraded to support a combined transit-retail payment card. The extent of the upgrade depends on the technology being used for the combined payment cards.

For example, if a multi-technology card is used (magnetic stripe for retail payment and contactless chip for transit payment), the retailer would only need to upgrade POS systems if they are supporting reload of the transit payment e-purse.

If the combined payment card is using contactless technology for both retail and transit payment, the retail POS systems would need to be upgraded to communicate with the new contactless payment cards.

The cost of upgrading POS systems can be significant. This cost would be a deterrent to a sole proprietor and to a regional or national chain retailer if the return on investment for upgrading is not timely and measurable.

How payments are processed must also be considered (e.g., how the retailer POS application and system handles the transaction and how and where the transaction is routed for processing). Using a multi-application smart card, each transaction can be routed through the correct settlement procedure, either transit or retail-financial. Use of a multi-application smart card could require less change to the retail payment infrastructure.

Business Issues

For a combined transit and retail-financial card to be successful, the participating organizations must address certain key business issues.

Fraud Exposure and Liability

Fraudulent transactions are a cost of doing business in any payment market segment. Partners in a transit-retail payment scheme must consider and define the liability for payment fraud.

The use of a transit card for payment outside of the transit system is analogous to a merchant switching from accepting a private label card to accepting a general purpose cobranded credit card. In the private label environment, a credit card is issued by a retailer for use in their store only. The credit policy is typically somewhat more liberal, because the motivation for the retailer is to sell more goods. Providing more customers with higher levels of credit helps accomplish this goal, enabling customers to “buy now and pay later.”

The economics of risk work in the favor of the retailer issuing a private label card. If an account does go bad, the actual losses are effectively limited to the cost of the goods sold, not the entire amount of the account. Once a retailer issues a cobranded card (such as a card branded with Visa or MasterCard), the card can be accepted at other locations, so the stakes are raised. Now when losses are incurred, the losses are at face value, since money has been paid to other merchants who have accepted the card.

Similarly, within the transit industry, fraud results only in a loss of opportunity for the operator. The operator incurs no additional cost relative to operating a train or bus as a result of the consumer’s ridership. Therefore, the actual loss is limited to reduced revenue and possibly the cost of adjusting and servicing the cardholder’s account.

When a card is accepted outside the transit network, the operator is exposed to additional losses associated with fraud. Any cost associated with fraudulent action outside of the transit environment is actually an expense to the transit operator, because funds must be paid to the retailer but no funds will be provided by the cardholder.

Business Objectives

To determine a proper market strategy for a combined card, it is important to assess the transit organization’s overall mission and business objectives.

Efficiencies and quality control. Establishing an extensive network of merchants can help provide additional sale and load facilities for a fare collection service. If this is a primary objective of the transit system, a dedicated service group (either in-house or outsourced) is necessary to recruit outlets, manage the performance of those outlets, and address any service quality issues.

The merchant channel can initially provide a mechanism for expanding the distribution of the card. The card can subsequently provide a mechanism by which the merchant can gain value. Much of the infrastructure put in place to manage the flow of funds associated with selling the card can provide settlement services for processing payments.

Revenue sources. Payment processing can represent a new source of revenue. Such revenue can help offset the costs of upgrading the revenue accounting function. In this environment, the transit company assumes a

much greater role in establishing the transit card as a means of retail payment.

Increased ridership. While increased ridership is the ultimate goal of any transit system, if this is the transit operator's only goal, the operator may be best served by having a third party administer the fare payment program. The third party can administer cards, move funds, and serve customers, while the transit operator focuses on the core business of ensuring that transportation assets are used to serve traveler needs. Such a relationship must ensure that information flows freely between the two organizations, as transaction data from the fare accounting system can provide insights into customer use and travel patterns.

Personalization and Issuance

Personalization is the process by which unique data gets added to the card. This data can take the form of the traditional physical personalization of a card such as embossing or graphics printing on the surface and it can take the form of electrical personalization such as writing to the magnetic stripe and writing to the chip of the smart card.

For chip personalization, data appropriate to the application on the card needs to be written to the card. Data stored may be encrypted or unencrypted depending on the application requirements.

Standards play an ever-increasing role in simplification of the personalization process. GlobalPlatform leads the effort to provide standards for the personalization process regardless of the type of card involved or the specific market in which it is used. Standardization and consolidation of the chip operating systems from the many proprietary versions to the few multi-application operating systems such as GlobalPlatform, Java Card and MULTOS also play a significant role in making personalization almost routine.

As described in the previous section, a combined transit-retail payment card could be issued by the transit operator, the financial services partner or both (or a third-party service bureau). In a transit-retail payment collaboration, partners would need to send the appropriate data to the card issuer to support the multi-application personalization process.

Card Costs

The differential cost of deploying contactless smart cards depends on what security and functionality they provide. A stored value card could be either a low-cost non-reloadable card with a low-cost memory chip or a reloadable memory card that allows the card to have a longer life.

A multi-application card may require a dual-interface microcontroller, with the cost of the card varying based on the memory and security requirements of the chip. The greater the memory requirements are, the more expensive the chip will be.

Customer Service

Besides branding issues, the greatest challenge to issuing a cobranded card is the servicing of customers. Most entities strongly believe that customer service is a competitive advantage. Relinquishing customer contact is often an emotional and difficult decision to make. However, in the best interest of the consumer, it is best to consolidate customer service with the card-issuing entity, or their designated processor, eliminating potential customer confusion and frustration.

Providing consolidated customer service requires both additional training of the customer service representatives, as well as integration of customer information systems. Customer service representatives must be trained in the basics of the new technology and applications and be provided access to the databases that can provide resolution to frequently experienced issues.

Recognizing that all issues will not be immediately resolved through available information, processes and procedures need to be established between entities, along with service level agreements, to ensure that all queries are resolved on a timely basis. In addition, issuers and application providers need to communicate regularly to ensure that servicing trends (e.g., increasing frequency of specific issues) are identified so that corrective action can be taken to minimize their occurrence.

Responsive customer service is critical to the success of smart card-based transit payment systems. Customer service must be accessible and efficient, especially as transaction values and volumes increase.

Life Cycle Management

A related aspect to customer service for multi-application cards is the concept of card life cycle management (CLCM). Unlike traditional magnetic stripe payment cards, where the content of the card remains static throughout its useful life, a contact or contactless smart card provides a dynamic environment. Applications can be added, modified or deleted from the card while it is in circulation based on customer needs, software version evolution and the valid period of the application.

CLCM provides the tools to interface to multiple applications providers and administer their rights to data, document the available resources on the card (e.g., memory, processing speed, operating system), and record the details of the resident applications (e.g., owner, version).

This information will be key to servicing customers, especially in situations where the card has been lost, stolen or rendered inoperable. While the CLCM may not know the 'current state' of each application relative to value and activity, in most cases, it will be able to replicate the last known state through interaction with the various application providers to allow for both replacement and reissue.

In addition, the consolidation of this information into a centralized system will provide customer service representatives with the information necessary to resolve most customer queries while establishing a foundation for self-service.

Transit Operator and Card Issuer Economic Business Case

Each party will derive benefit from a partnership in different ways and each will have a cost and revenue model associated with their activities and commitments. As transit cuts across a wide spectrum of demographic and transit usage profiles, some transit application users will have great value to the issuer in building transaction volume against the card and providing a powerful value proposition to consumers. Other transit application users may have a lower expenditure profile or a different demographic profile and be of less value to the card issuer. A variety of questions must be answered in arriving at the ultimate arrangement between card issuer, transit authority or the transit authority's agent.

- What is the profile of the targeted cardholder?

-
- What applications may be marketed to the cardholder and how does the synergy between the transit application and these other functions create value?
 - What is the anticipated transaction volume for the card and how much revenue might that create for the issuer?
 - What is the anticipated mix of applications and what card platform and associated cost does that imply?
 - What efficiencies can be created regarding card orders, card handling, initialization, personalization, and distribution among the card and application issuers?
 - How can application and card issuers benefit from the development of synergistic applications and technology solutions?
 - What is the value of data that may be obtained through opt-in programs provided to cardholders?

Consumer Issues

Consumer issues represent an additional factor in the decision to issue a combined card.

Consumer Acceptance

Consumers must be encouraged to use a multi-application transit-retail card. Providing incentives and establishing links to neighboring retail outlets will encourage consumers to perceive such a card as having more value and will provide greater motivation to use the combined payment card.

Branding is one of the key issues to be considered in the launch of a multi-application smart card. For a card to be used outside of a defined environment (such as a transit system), additional card capabilities must be marketed to the consumer. First, the consumer must be aware that the card can be used to purchase goods other than transit fares. There is then the additional problem of identifying which retailers accept the card. As the size of the accepting merchant base grows, there arises a need to identify which merchants accept the card so that consumers can match the card with some indicator that denotes merchant acceptance.

Displaying the card. One method of denoting card acceptance is by displaying a picture of the card at the merchant site (as is done for American Express and Discover cards). Such an approach works best when one issuer assumes complete responsibility for serving both the cardholders and the merchant population. Such an approach can be limiting or restrictive in a multi-operator transit collaboration, since operators may lose some control over customer data or funds access due to the centralization of these functions.

Displaying a mark. A mark approach signals that a card is accepted by displaying a common mark or brand (analogous to the MasterCard and Visa models, in which multiple banks issue the card but the common element between all issuers and merchants is the mark). This approach is most applicable in an environment where more than one entity issues and services a card.

In a greater metropolitan area, for example, where multiple transit operators may be involved, each operator may want to retain control over their customer data and service. To accommodate this environment, the regional administration can establish a mark or brand that is added to each operator's

card. This same mark is also prominently displayed at merchant locations that accept the cards. A mark can also be used to identify cards issued by a consortium of stakeholders that includes non-transit entities.

Indicating an application. Acceptance of an application hosted by a card is the most intangible way to communicate card acceptance. Fortunately for contactless cards, the presence of a reader, which can be emblazoned with logos or messages, allows the cardholder to recognize terminals that are equipped to accept the card. Once additional applications are placed on a card, however (in both contact and contactless environments), card acceptance is more a process of trial and error, with the terminal ultimately recognizing whether the card hosts an application that can be processed. The result is typically customer confusion. But an application approach to program deployment is ultimately the most flexible and strategic, since such an approach allows a service to be added to a card after issuance, when it is not always possible to add a mark or logo.

This approach offers the most market benefit to transit companies that market their applications (for example, “your rail pass can now be used to make purchases at these locations”). Not being tied to specific branding allows issuers to gain greater market share at a lower cost, since the application can leverage other issuers’ investments in technology. Accordingly, transit application issuers can piggyback on cards being issued as government and corporate ID cards or as bank debit and credit cards.

Consumer Usage of Payment Types

The customer base for a combined card is diverse. Transit and financial institutions must therefore develop a comprehensive business plan to address the needs and requirements of all types of customers. For example, a combined card must be appropriate for both “banked” and “unbanked” consumers (i.e., consumers who do not have a bank account, estimated at 13% of all U.S. households³⁴).

Consumers who do not qualify for a revolving credit line could be offered stored value cards that would permit them to pay for a prescribed amount of travel. Consumers who qualify for credit could be issued a cobranded multi-application card that could be used as a transit card and a retail payment card.

³⁴ Giesen, op. cit.

Conclusion

The benefits that contactless smart cards bring to transit payment are clear and have been proven in numerous automatic fare collection systems worldwide. The exciting new development for transit operators is the ability to use these contactless smart card-based systems to extend payment beyond a single transportation mode or region or into retail purchases, or to collaborate with partners on other complementary applications.

While transit operators in the United States are investing in new contactless smart card-based payment systems, the financial services industry is exploring the use of contactless payment cards. U.S. pilots are underway to measure and prove the business case of contactless retail payment for issuers and retailers. Increased convenience for the consumer can result in increased sales and faster transaction times for the retailer. The retailer also has lower costs, due to fewer requirements to handle cash, improved operational efficiencies, and lower maintenance costs resulting from improved reliability of card readers.

Common requirements – for fast, secure, accurate, reliable, and convenient payment – indicate an opportunity for collaboration and partnerships. Using multi-technology or multi-application smart payment cards, transit and financial services partners can implement combined transit-retail payment capabilities that increase consumer convenience, deliver value to retailers, and lower overall issuing and operating costs. However, business and technical issues are barriers to collaboration, including selection and use of compatible standards, use of a common payment methodology, selection of compatible operating systems and security approaches, upgrade of retailer point-of-sale terminals, changes in fraud exposure and liability, and development of programs to drive consumer acceptance. Resolution of these issues is critical to developing combined payment approaches that can be used across the transit and retail-financial industries.

Strategically, this is the time for transit operators to explore the potential for linkages to formerly disparate markets and develop partnerships with employers, financial service providers, retailers, and other transportation service providers. By leveraging the new contactless smart card infrastructure, transit operators and their partners can differentiate product and service offerings and create a strategic competitive advantage.

For more information about smart cards and the role that they play in payment and other applications, please visit the Smart Card Alliance web site at www.smartcardalliance.org or contact the Smart Card Alliance directly at 1-800-556-6828.

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Appendix A: Definition of Terms & Acronyms

Account-based stored value card

A consumer prepaid payment card, with monetary value stored in an account that is accessed and value updated when the consumer uses the payment card.

AFC

Automatic fare collection system.

APTA

American Public Transportation Association

ATM

Automated Teller Machine

Card-based stored value card

A consumer prepaid payment card, with monetary value stored on the card. When the card is used, the transaction amount is decremented from the value on the card by the terminal at the point-of-sale, without connecting to an issuer system.

Chip

Electronic component that performs logic, processing and/or memory functions.

Contact smart card

A smart card that connects to the reading device through direct physical contact between the smart card chip and the smart card reader. (See ISO/IEC 7816.)

Contactless smart card

A smart card whose chip communicates with the reader using RF and does not require physical contact with the card reader.

Dual-interface chip

A single smart card chip (microcontroller) with two interfaces – a contact and a contactless interface – using shared memory and chip resources.

Electronic purse (epurse)

A payment card application that is used to replace cash. The epurse holds monetary value, either on the card or in a central account on a host system that communicates with the payment card. See also stored value payment.

EMV

Europay MasterCard Visa. Specifications developed by Europay, MasterCard and Visa that define a set of requirements to ensure interoperability between payment chip cards and terminals.

Hybrid card

A smart card that contains two smart card chips – both contact and contactless chips – that are not interconnected.

IEC

International Electrotechnical Commission.

Integrated circuit

See chip.

ISO

International Organization for Standardization.

ISO/IEC 14443

ISO/IEC standard "Identification Cards - Contactless Integrated Circuit(s) Cards - Proximity Cards."

ISO/IEC 7816

ISO/IEC standard for integrated circuit cards with contacts.

Logical access

Access to online resources (e.g., networks, files, computers, databases).

MCU

See microcontroller.

Microcontroller (MCU)

A highly integrated computer chip that contains all the components comprising a controller. Typically this includes a CPU, RAM, some form of ROM, I/O ports, and timers. Unlike a general purpose computer, a microcontroller is designed to operate in a restricted environment.

Micropayment

A low value transaction (<\$20) that is most often paid with cash.

Multi-application card

A smart card that runs multiple applications – for example, electronic purse physical access, logical access, and data storage – using a single card.

Multi-technology card

A smart card that has two or more technologies that are independent and that don't interact or interfere with one another. An example is a card that contains a smart card chip and a magnetic stripe.

Multi-technology reader

A card reader/writer that can accommodate more than one card technology in the same reader.

Physical access

Access to physical facilities (e.g., buildings, rooms, airports, warehouses).

PIN

Personal Identification Number. A numeric code that is associated with a payment or an ID card and that adds a second factor of authentication to the identity verification process.

POS

Point-of-sale

RF

Radio frequency.

RFID

Radio Frequency Identification.

Smart card

A smart card includes an embedded chip that can be either a microcontroller with internal memory or a memory chip alone. The card connects to a reader with direct physical contact or with a remote contactless electromagnetic (RF) interface. With an embedded microcontroller, smart cards have the unique ability to store large amounts of data, carry out their own on-card functions (e.g., encryption and digital signatures) and interact intelligently with a smart card reader.

Stored value payment card

A payment card that holds a monetary value for use by a cardholder, with the value stored either in an account held by the issuer or on the card itself.

UTFS

Universal Transit Farecard Standards.

Appendix B: Retailers Accepting the Hong Kong Octopus Card

The table below lists the transit, retail and other service providers who accept the Hong Kong Octopus card.³⁵

Transit Partners	Transportation
MTRC KMB CITYBUS KCRC New World First Bus New World First Ferry	Peak Tram New Lantau Bus (26 lines) Discovery Bay (Bus) to Tung Chung/Airport Sun Bus Star Ferry Airport Ferry Discovery Bay Ferry Tramway Eastern Ferry (AP Lei Chau to Aberdeen)
Retail Services	Parking
Maxim's Fast Food (80 stores) Maxim's Cake Shop (110 stores) 7-Eleven (400 stores) Hop Fat Restaurant (1 store) North District Hospital Canteen Starbucks Coffee Shop (10 stores) Tsui Wah Restaurant (4 stores) Bread Boutique Trail (11 stores) Circle K add-value service (140 stores) McDonald's trial (16 stores) Lucky Bakery House (1 store) Ocean Park Gift Shops HKUST Canteen Daily Stop Newspaper Express Counter (2 stores) Broadway Cinema Kiosks (10 stores) Murray Catering Tuck Shop (10 schools) Cherikoff Bakery (1 store) Hoixe Bakery (1 store) St. Theresa Hospital Canteen Orchid Padaria Bakery (8 stores) Café de Carol (Full implementation) Circle K payment service (140 stores) Circle K newspaper express counter (5 stores) Park'N Shop (express lanes – 70 stores) Artride Café – 1 store Simply the Best Hui Lau Shan Watson's Retail Take A Break	Ocean Park (car park) Wilson Parking (28 sites) Ocean Terminal Car Park Kornhill Car Park May Road Car Park Sino Parking – Island Resort Vinci Park (1 site) Kwik Park (9 sites) Paradise May Sino Parking – Olympic city 1, 2 Swire Property Edward Keller – Law's Commercial Plaza
Other	Vending Machines
Maxicab/Minibus Coach Recreation Facilities School Project	Swire Bottle (3,200 vending machines) Vitasoy Vending Machines (400 machines) Euro Vending Machines (10 machines) Watson's Vending Machines (10 machines) Jisou Vending (5 machines) Telestation Telephone Cards (4 machines) ESDLife Kiosk (20 machines)
	Access Control
	Tierra Verde Tung Chung Crescent Waterfront Ocean Shores Phase 1 Bay Crest Island Harbour Hilton Tower Graces Court
	Leisure & Culture Service Department
	Public Swimming Pool (all 35 pools) Tennis Court Booking (all 21 tennis courts) Public Library trial (3 libraries)

³⁵ Source: ERG Group, www.erggroup.com.