



Association for Commuter Transportation

A SECURE TECHNOLOGY ALLIANCE TRANSPORTATION COUNCIL AND
ASSOCIATION FOR COMMUTER TRANSPORTATION WHITE PAPER

Multimodal Payments Convergence – Part One: Emerging Models and Use Cases

Version 1.0

Date: March 2017

Secure Technology Alliance

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About the Secure Technology Alliance

The Secure Technology Alliance is a not-for-profit, multi-industry association working to stimulate the understanding, adoption and widespread application of secure solutions, including smart cards, embedded chip technology, and related hardware and software across a variety of markets including authentication, commerce and Internet of Things (IoT).

The Secure Technology Alliance, formerly known as the Smart Card Alliance, invests heavily in education on the appropriate uses of secure technologies to enable privacy and data protection. The Secure Technology Alliance delivers on its mission through training, research, publications, industry outreach and open forums for end users and industry stakeholders in payments, mobile, healthcare, identity and access, transportation, and the IoT in the U.S. and Latin America.

For additional information, please visit www.securetechalliance.org.

About the Association for Commuter Transportation

The Association for Commuter Transportation (ACT) is an international trade association and leading advocate for commuter transportation and transportation demand management. Commuting by bus, train, rideshare, bike, walking, or telework improves our world by contributing to energy independence, better air quality, sustainability, urban mobility, and reduced congestion. Our members include public sector transportation agencies, employers, universities, transportation management organizations, and mobility providers working together to expand options and improve our commute.

For more information, go to: www.actweb.org.

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1 Background

Transportation providers have adopted a variety of payment technologies, such as contactless smart cards, electronic tolling, and mobile payments for transit, parking, and shared use transportation, that make travel more convenient and efficient. In some regions, integrated payment systems let multiple transit agencies accept the same contactless smart card or mobile ticketing application. Toll agencies, such as members of the E-ZPass Interagency Group, have adopted common toll tag technologies and share payment data to allow the same toll tag to be used in multiple states. Recently, several transit agencies have started to implement open, account-based payment systems that enable travelers to use many types of payment media or identification credentials to access transit services. Mobile ticketing and contactless payment using mobile devices have been implemented at many transit and parking agencies.

In most urban areas, the mobility options from which travelers can choose are expanding. Services such as bike share, car share, and ride-hailing have grown rapidly. Travelers can get real-time information on available transportation options and make selections based on the current situation.

Integration of payment services for any type of transportation, or multimodal payments convergence, is a natural extension of these capabilities. This paper describes four types of convergence that have been implemented; other types could emerge in the future.

The Secure Technology Alliance Transportation Council recognized the trend toward multimodal mobility at the 2014 Payments Summit and initiated activities to explore the potential for multimodal payments convergence. In January 2015, the Transportation Council hosted a workshop on payments convergence that was attended by representatives from transit agencies and from tolling, parking, and intelligent transportation system and shared-use mobility associations. The workshop participants recommended continuing discussions about potential opportunities for multimodal payments convergence. Payments convergence was a featured topic at several transportation industry conferences during 2015 and 2016, generating substantial interest. The shared use mobility industry (car share, bike share, ride-hailing) is particularly interested in payments convergence, and the Association for Commuter Transportation (ACT), whose members include many shared-use mobility providers, asked to be involved in the Secure Technology Alliance efforts.

The Secure Technology Alliance Transportation Council and the ACT initiated development of this white paper in the fall of 2015. Other industry groups, such as the Shared Use Mobility Center, also contributed. The white paper describes emerging types of payments convergence and provides current examples of convergence. A future white paper, *Multimodal Payments Convergence—Part Two: Challenges and Opportunities for Implementation*, will describe alternative visions for payment systems, identify many of the potential barriers to implementation of multimodal payment strategies, and suggest ways of addressing these challenges.

2 Introduction

Multimodal payments convergence is intended to make travel more convenient, making it easy for travelers to pay for transportation regardless of mode. Multimodal incentives and discounts can be provided as part of the payment process to influence travel behavior. Multimodal payments convergence can take a variety of forms:

- Using the same payment medium or technology to pay for or access services on multiple modes of transportation.

For example, a single contactless smart card or mobile ticket app could be used to pay for different types of transit; a transit contactless smart card could unlock a shared bike or car; a highway toll tag could access an Amtrak station parking garage.

- Linking payment accounts for multiple modes of transportation, such as for transit and tolling or for transit and bike share.
- Providing a Web portal or mobile application to pay for trips involving multiple modes of transportation.

For example, a mobile app or linked apps could be used to pay for transit and ride-sourcing.

These forms of payments convergence are appearing in many regions of the United States and abroad. As the use case examples in Section 3 illustrate, a single region may be implementing multiple forms of convergence.

Future multimodal approaches could combine the payment services for multiple modes (for example, combining customer service centers) to improve convenience or reduce costs.

2.1 Emerging Models of Payments Convergence

The use of contactless smart cards for transit payments was first introduced in the mid-1990s. Since then, payment systems have evolved to meet the changing needs of transportation customers and service providers. Many travelers now use multiple modes of transportation operated by different public or private organizations. Transit operators collaborate with shared-use mobility providers (car sharing, bike sharing, ride-sourcing) to provide first mile/last mile service and complement fixed-route rail or bus transit service. Multimodal payment convergence supports these new models of mobility by making it more convenient to pay for any type of transportation service.

There are currently four types of payment convergence:

1. Use of a common payment technology
2. Linked or integrated mobile apps
3. Common or linked payment accounts
4. Incentives or co-marketing

Most regions have introduced more than one type of convergence, as shown in Table 1.

2.1.1 Use of a Common Payment Technology

Payment systems based on contactless smart card technology allow customers to use the same card to pay for transportation on subways, light rail, buses, or ferries administered by different transit agencies in a region.

The first large transit system to implement a regional smart card payment system was the Washington Area Metropolitan Transit Authority (WMATA) (Section 3.11). The WMATA-issued SmarTrip card can be used on subways and buses on WMATA and with other transit agencies in the region; a compatible smart card is also issued by the Baltimore transit agency. Another example of a regional transit payment card is the Clipper card, issued by the Metropolitan Transportation Commission (MTC), the metropolitan planning organization for the San Francisco Bay Area (Section 3.9). Clipper cards can be used on buses, the subway, light rail, and ferries run by over 20 transit agencies. SmarTrip and Clipper cards can also be used to access some transit parking facilities.

Most of the regional smart card payment systems implemented to date are card-based systems: value is stored in card memory. While these systems make payment simple and convenient for the traveler, design and governance are complex. The smart card system back end, or fare engine, must support the variety of fare policies used by the participating transit agencies. The different transit agencies must all implement compatible card and reader technology and must agree on how they will exchange revenue as part of the payment settlement process.

Transit agencies are beginning to implement open payment system architectures in which equipment must meet prescribed standards for smart card technology and payments. This architecture enables a transit agency to accept payment cards issued by other organizations, such as banks, and prepaid cards. Many stakeholders consider open payments systems to be a form of multimodal payments convergence, as the same payment media and accounts can be used for many types of services.¹ Other types of payment relying on compatible mobile technologies can also be accepted, including Near Field Communication (NFC) enabled mobile devices with mobile wallets and apps.

Mobile payment systems are currently well-accepted by the customers of many transit agencies and are used as proof-of-payment devices on light rail, bus, and commuter rail services. Mobile payments can take the form of mobile ticketing, which resembles an electronic flash pass or can emulate contactless smart cards on smart phones that support NFC.

Use of transit payment smart cards to access other modes of transportation, such as bike share, car share, or ride-hailing, has not been widespread because it is often difficult to use this form factor on these types of systems. Bike share systems can accept transit smart cards if smart card reader technology is incorporated into the bike docking station. A demonstration in Chicago developed a special hybrid smart card with two chips that could be used to access a car share vehicle or ride the transit system. In Minneapolis-St. Paul, the transit Go-To payment card can be used to unlock an HourCar shared car. In several regions, the E-Z Pass radio frequency identification tags used to pay highway tolls can also pay for parking at Amtrak rail stations and airports.

2.1.2 Linked or Integrated Mobile Apps

With many travelers using mobile devices, public transportation agencies and commercial data integrators are developing mobile apps and Web portals that provide information on a wide range of travel options. These apps can detect a traveler's location and provide real-time information on the closest transit, ride-sourcing, and car and bike share options. Travelers can use these apps or portals to plan trips, book services, and pay for services. When mobile payment is used on transit services, the mobile device can be accepted as a mobile ticket or emulate a contactless smart card.

¹ "Transit and Contactless Open Payments: An Emerging Approach for Fare Collection," Secure Technology Alliance Transportation Council white paper, <https://www.securetechalliance.org/publications-transit-financial-2011/>.

Software development kits and application programming interfaces have been developed to facilitate linking different public and private organizations' trip planning, booking, and payment apps (see TriMet use case in Section 3.5). In some cases, national business-to-business partnerships have been developed, with apps that allow customers to book and pay for different modes of service (see ZipBike use case in Section 3.12). In all cases, mobility data integrators must have data sharing agreements with every service provider to access real-time information on the availability of their services.

Several models are emerging for linking payment apps. In one approach, the traveler information system or trip-planning portal developed by a public transit agency or a commercial data integrator has a "soft link" to various service providers' apps, which are used to book and pay for the trip.

In another model, payments are collected by the data integrator, which then passes transaction payment information to the service provider. A variation of this model is to have links from the list of transportation options to the traveler's account with a financial institution. When the service is selected, the payment is processed by the existing payment infrastructure.

Finally, in the mobility-as-a-service approach, a mobility manager provides travelers with a multimodal mobility account. All types of transportation services are paid for through the traveler's mobility account, and the mobility manager arranges for services from individual companies and agencies in a way that is transparent to the traveler. This approach requires exchanging tokens representing payment with the service providers.

2.1.3 Common or Linked Payment Accounts

Many transportation payment systems are now being designed to be account-based systems. Account-based systems offer a flexible way to use a variety of payment media, such as smart cards or mobile devices. In an account-based system, fares are calculated in the back office. The account balance is stored in the customer's account rather than on the payment media.

Account-based transit payment systems have been implemented in Salt Lake City and Chicago and are being developed for new transit payment systems in Philadelphia, Los Angeles, and several other locations. For example, a traveler's account in the Chicago Transit Authority Ventra program can be used for payment on the subway, bus, or commuter rail. The traveler has one account, and it can be linked to different payment media and different modes of transportation.

Although designing and managing account-based systems can be complicated, these systems can be used for multiple types of transportation more easily than other payment systems. For example, a traveler's account can be linked to a contactless card for bus and subway fares and a mobile ticketing app for commuter rail fares. The Los Angeles Metro is leveraging their customer relationship management system to create transit customer accounts that can be extended to pay for bike share.

Several regions in North America have considered the idea of a universal travel or mobility account. Multimodal mobility accounts have already been demonstrated in Gothenburg, Sweden, and Helsinki, Finland (Table 1), and may be implemented throughout Finland as part of the Ubigo program. This approach, sometimes called mobility-as-a-service, allows travelers to use a mobility account to pay for any type of transportation service. The traveler has an account with a regional mobility manager, which collects payments, arranges services, and reimburses service providers as part of a payment settlement process. Multimodal mobility service demonstration systems were very popular when tested in Finland and Sweden and appeared to encourage non-automobile travel. However, numerous details relating to governance and the business model must be resolved before mobility-as-a-service can be implemented.

2.1.4 Multimodal Incentives or Co-marketing

Many transit authorities are now co-marketing with transportation service providers who complement their services. Transit agencies may allow shared-use mobility providers such as car share, bike share, and ride-sourcing companies to market their services on the transit authority's website or mobile app. Often this marketing includes discounts to incentivize the use of shared-use services to reach transit. Discounts may also be offered by retail outlets, by service providers, or at events in areas served by transit. These incentives can help increase sales and transit use and contribute to regional transportation goals such as reducing congestion, air pollution, and energy use. Other incentives may support social goals such as public health by providing discounts for healthy types of travel such as bike sharing.

Mobile and account-based payment systems can facilitate dynamic, time-sensitive incentives to change travel behavior. For example, some regions give discounts on transit fares when the air quality is poor to encourage travelers not to drive.² Incentives can also be used to influence travel behavior based on regional transportation conditions. In Washington, D.C., for example, ride-sourcing, car and bike sharing, and parking companies are providing discounts to customers during an extended maintenance program on the rail transit system.³

Payment systems can support transportation agency development of promotions that use gamification to encourage traveler behavior that furthers regional transportation goals. Discounts and prizes have been used in Singapore and Los Angeles to encourage travelers to use transit or travel at off-peak times. Transit agencies may also collaborate with retailers to engage in gamification that promotes transit use. Portland's transit agency, for example, used mobile devices and beacon technology to create scavenger hunts in which travelers were rewarded with retail discounts when they found particular promotional materials on a new transit line (Section 3.5.2).

2.1.5 Examples of Multimodal Payments Convergence Implementations

Table 1 lists some current examples of multimodal payments convergence implementations. The type of payments convergence approach for each region is shown with a short description of the region's implementation.

Please note that Table 1 and Section 3 list examples of payments convergence implementations and are not intended to include all implementations or all available convergence solutions⁴.

Section 3 describes payment convergence in most of these locations.

² Whitney Evans, "Salt Lake County Gives Out Free Transit Trips to Clear the Air," KUER1 News, Jan. 29, 2015.

<http://kuer.org/post/salt-lake-county-gives-out-free-transit-trips-clear-air-0>

³ Christina Sturdivant, "Uber, Car2Go and Others Offer Deals Ahead of Metro's SafeTrack Launch," DCIST, May 26, 2016.

http://dcist.com/2016/05/uber_car2go_provide_deals_ahead_of.php

⁴ Company, product and service references are included with the examples to document the use cases. This white paper does not endorse any specific company, product or service.

Table 1. Examples of Payments Convergence Implementations

Location	Common Payment Media	Linked or Integrated Mobile Applications	Common or Linked Payment Accounts	Multimodal Incentives or Co-Marketing
Austin, TX	—	CapMetro mobile app by moovel is linked to Haffos mobile ticketing for payment of bus or light rail transit. The transit app links to apps for B-cycle bike share and Chariot micro-transit vans.	—	—
Boston, MA	<p>CharlieCard smart card can be used on subway, light rail, and bus.</p> <p>The mTicket mobile ticket can be used on commuter rail and boat.</p> <p>The PaybyPhone mobile app can be used to pay for commuter rail parking.</p>	<p>The mTicket mobile ticket app can be used to plan trips and buy mobile tickets for commuter rail and ferry.</p> <p>The PaybyPhone mobile app can be used to pay for commuter rail parking.</p>	A MyCharlie account can be used to add value to a CharlieCard.	A medical center gives discounts to eligible patients for bike share memberships.
Chicago, IL (Section 3.1)	<p>The Ventra contactless smart card is accepted for payment on CTA subway and bus and PACE suburban bus transit.</p> <p>A Ventra card that is co-branded with a financial institution can be used for retail purchases.</p> <p>The Ventra mobile app can be used to add value to the Ventra card and check a Ventra account balance.</p> <p>A no longer active demonstration used a hybrid smart card (two chips and two antennae) for transit payment and car share access.</p>	<p>The Ventra mobile app allows customers to add value to a Ventra card for subways and buses and purchase mobile tickets for Metra commuter rail. A demonstration project will enable riders to use the Ventra app to locate, book, and pay for Divvy bike share.</p> <p>Future plans are to link to a multimodal trip planner, and enable contactless payment on subways and buses with an NFC mobile app.</p>	<p>A Ventra account can be used to add value to a Ventra card or Metra mobile ticket.</p> <p>A demonstration in 2017 will enable travelers to pay for bike share with their Ventra transit account value.</p>	—

Location	Common Payment Media	Linked or Integrated Mobile Applications	Common or Linked Payment Accounts	Multimodal Incentives or Co-Marketing
Dallas, TX (Section 3.2)	The GoPass mobile ticketing app can be used on light rail, bus, and commuter rail.	The GoPass mobile ticketing app has a “soft-link” to TNCs and car share apps. Under the “On-Call Service Replacement Program” pilot, the under-served population with a DART ticket can use TNCs as an alternative to DART-contracted on-demand vehicles. DART will demonstrate a multimodal trip planning and payment app including transit, ride share, car share, bikeshare options.	The transit rider system is account based. An account-based taxi program has been introduced for seniors, mobility challenged customers, and those in under-served areas. Taxi accounts do not require a financial account. DART will demonstrate extending their account-based transit payment system to other modes, and providing payment settlement among the service providers.	Seniors and mobility-challenged customers with a DART taxi account can purchase up to \$100 in taxi services for 25% of the value.
Gothenburg, Sweden (Ubigo mobility-as-a-service demonstration)	—	A mobile app provides access to book transit, car share, bike share, ride-hailing, and taxi services.	Demonstration program included 70 subscribers who had mobility accounts.	—
Helsinki, Finland (Mobility-as-a-service demonstration)	—	A mobile app provides access to book transit, car share, bike share, ride-hailing, and taxi services.	Mobility-as-a-service subscribers have mobility accounts. Consumers are billed by the trip or monthly.	—
London, England (Section 3.3)	The Oyster contactless smart card is accepted by multiple forms of bus and rail transit. Transport for London also accepts contactless bank cards, Apple Pay, and Android Pay for transit trips.	—	—	—
Los Angeles, CA (Section 3.4)	The TAP contactless smart card is accepted by 20 transit agencies for bus, subway, and light rail.	LA Metro and City of LA trip planning apps plan to link to apps of ride-hailing companies and other service providers for booking and payment.	TAPForce customer relationship management software is the platform for transit customer accounts. Transit account data can be linked to bike share account data, and may be merged in the future. Data are exchanged	ExpressLanes customers are given credit for use of LA Metro express bus or car-pooling. Car poolers are given chances to win gift cards.

Location	Common Payment Media	Linked or Integrated Mobile Applications	Common or Linked Payment Accounts	Multimodal Incentives or Co-Marketing
			between TAP card accounts and ExpressLanes accounts to give discounts. LA Metro is exploring unattended, ungated parking payment using license plate readers, and using the transit TAP card to identify transit riders. Future plans could use a multimodal purse in the customer's account to distinguish between transit and parking benefits.	
Philadelphia, PA	SEPTA TrailPass is accepted for bus, trolley, light rail, subway and commuter rail. SEPTA Key is accepted for bus, trolley, light rail, subway, commuter rail and parking. Valid SEPTA weekly and monthly TrailPasses are accepted by neighboring DART for all bus trips within Northern New Castle County in Wilmington, DE.	—	—	A 2016 demonstration with Uber offered discounted last-mile connector fares.
Portland, OR (Section 3.5)	—	The TriMet Tickets mobile ticketing app is used for payment on MAX light rail, TriMet bus, Portland street car, and WES commuter rail. The RideTap software development kit links a trip planning app to the TriMet Tickets app and to the booking and payment apps for Lyft ride-sourcing, car2go and Zipcar car sharing, and BIKETOWN bike sharing.	—	Co-marketing ride-sourcing, car sharing and bike sharing are on the transit app. Mobile ticketing app and beacon technology are used to deliver retail discounts for stores along a new transit line under the "Orange Marks the Spot" program.

Location	Common Payment Media	Linked or Integrated Mobile Applications	Common or Linked Payment Accounts	Multimodal Incentives or Co-Marketing
Raleigh, NC (Section 3.6)	–	There is a trip planning partnership between Triangle Transit, Uber, and TransLoc.	–	–
Sacramento, CA (Section 3.7)	The Connect Card contactless smart card is being introduced for use by at least nine Sacramento transit agencies.	–	Planned for 2017 is the use of the Connect Card as an account identifier, but not payment source, in multi-city bike share program.	Sacramento Regional Transit is reimbursing Uber, Lyft, and Yellow Cab for discounted trips taken to or from light rail stations.
Saint Petersburg, FL (Section 3.8)	–	–	Pinellas Suncoast Transit Authority will demonstrate a way for customers to call PSTA and pay for paratransit services from TNC companies.	Pinellas Suncoast Transit Authority is subsidizing first/last mile service provided by Uber and United Cab.
San Francisco Bay Area (Section 3.9)	The Clipper contactless smart card is accepted by 24 transit agencies for subway, bus, light rail, commuter rail, and ferry service and for some transit parking facilities.	The MuniMobile ticketing app can be used to purchase mobile tickets for use on Muni bus, light rail, cable car, and SF Access paratransit. Golden Gate Ferry has launched a mobile ticketing pilot to supplement Clipper limited-use ticket sales. BART will be demonstrating a seamless way to reserve and pay for carpool parking at BART stations.	Cardholders can register and manage their Clipper cards online. The Clipper program also offers its own transit benefit program—Clipper Direct.	The LAVTA transit agency is partnering with Uber, Lyft, and a taxi company to provide rides within a portion of LAVTA's service area. LAVTA is paying a portion of the ride cost.
Toronto, Canada (Section 3.10)	The PRESTO contactless smart card is accepted by 11 transit agencies for bus, subway, streetcar, and commuter rail services, with plans to expand to paratransit services.	–	A "My PRESTO" account can be used to load the PRESTO card for use on all participating systems.	–
Twin Cities, MN	The Go-To contactless smart card can be used for payment on Metro Transit buses and light rail and on Northstar	The Metro Transit mobile app is linked to apps for NiceRide bike sharing, car2go car sharing, and Lyft ride-sourcing.	–	–

Location	Common Payment Media	Linked or Integrated Mobile Applications	Common or Linked Payment Accounts	Multimodal Incentives or Co-Marketing
	commuter rail. The Go-To transit card can be used to access Hourcar car-share services.			
Washington, D.C./Northern Virginia/Maryland (Section 3.11)	The SmarTrip contactless smart card can be used for WMATA subway, bus, light rail, on-demand transit, and some transit parking. It is interchangeable with the Maryland Transit Administration CharmCard used in Baltimore.	The WMATA Web portal can be used to load value on the SmarTrip transit card or pay for private van pool services. The VRE Mobile app can be used for mobile ticketing on commuter rail. The DC Taxi app can be used to book and pay for a taxi or mini-van from any D.C. taxi company. It includes a cash payment option and accepts vouchers from disabled riders.	Customers can register their SmarTrip card and can link their SmarTrip account to a SmartBenefits employer subsidy account. Customers' SmartBenefits accounts can be used to load a WMATA SmarTrip card or VRE Mobile commuter rail mobile ticket. Payment for private van pools can be made from the customer's SmarTrip account.	Ride-sourcing, car and bike sharing, and parking companies provide incentives during a long-term transit maintenance program.
United States: National (Section 3.12)	—	In September 2016, Zipcar, one of the nation's largest car share providers, announced a partnership with bike share provider Zipbike to provide bundled car share and bike share services on university campuses across the United States.	—	—
United States: Regional (Section 3.13)	E-Z Pass Interagency Group and other regional groups of toll agencies have agreed to use the same toll collection technology and exchange and reconcile toll payment data among themselves.	—	Customers establish accounts with individual toll agencies, which exchange usage data with other agencies and reconcile payments according to where the toll tag was used.	—

3 Use Cases

This section describes example use cases chosen to illustrate innovation in multimodal payments. New initiatives are being announced and undertaken at a rapid pace⁵.

3.1 Chicago, IL

In November 2015, the Chicago Transit Authority (CTA) launched the Ventra mobile app. The Ventra app provides riders with a one-stop shopping experience, allowing users to add transit value and load passes to Ventra cards, check account balances, and receive real-time account alerts. The free app, which was developed by the CTA, Metra, and Pace, is available for use on Apple and Android smartphones and tablets. The app was provided through a partnership of Cubic Transportation Systems, the operator of the Ventra fare payment system, and moovel transit (formerly GlobeSherpa).

The Ventra app allows Metra riders to purchase and display tickets on a smartphone using a Ventra account or personal credit or debit card. The app supports the following traveler functions:

- Add transit value and passes
- Check account balances
- Manage funding sources
- View transaction history
- Sign up for customizable account notifications and alerts for account balance, low balance, expiring passes
- Use Metra mobile ticketing, using a Ventra account or personal credit or debit card

This is visual proof of payment—showing a ticket or pass on a mobile screen instead of presenting a paper ticket or pass to a Metra conductor.

Later phases will provide additional account management features (e.g., card ordering, replacing a lost or stolen card), multiagency transit tracking features, and an integrated regional trip planner with service information for CTA, Metra, and Pace that allows customers to navigate the region from door to door using all three transit systems. Customers will eventually be able to pay for rides on trains and buses directly from the Ventra app by touching the phone or device to a Ventra reader.

Under a mobility-on-demand sandbox demonstration funded by the Federal Transit Administration, CTA and the Chicago DOT plan to add Divvy bike station locations and status information to the transit trip planner, and enable customers to pay for a bike share pass using the Ventra transit app using value in their transit accounts.

3.2 Dallas, TX

Some residences and businesses within the Dallas Area Rapid Transit (DART) 13-city service area lie beyond walking distance to a bus stop or train station, denying some customers the ability to use the transit system. Many citizens have trouble completing the first or last mile of their commute.

DART tried several multimodal solutions to explore how modified services could increase ridership across the service area and create a better transit environment, not only for DART, but also for various

⁵ Company, product and service references are included with the examples to document the use cases. This white paper does not endorse any specific company, product or service.

ride share offerings. This goal requires a robust, easy-to-use mobile payment platform as well as car share, bike share, other rural transit systems, and first/last mile providers.

The first pilot program leveraged DART's GoPass mobile ticketing app, integrating it with TNCs and car share companies, to provide access to additional transportation options. Customers using the app can access travel tools and select "Connect 2 Car," which provides additional transportation options external to the DART services, such as Uber, Lyft, and Zipcar.

After the successful app integration, DART focused its efforts on zones within the 13-city service area where service penetration remained low, either due to lower ridership or the logistical issues involved in driving 40 ft. buses on certain roads. DART's "On Call" service typically uses contracted vans or vehicles, allowing customers to schedule trips 24 hours in advance. The service also allows customers to be transported to or from DART stations or a particular location within a zone by meeting vehicles running on a schedule within that particular zone.

This service proved to be unsatisfactory, due to pre-planning requirements and cost inefficiencies. As a result, DART implemented the "On-Call Service Replacement" pilot program, focusing on under-served DART zones and using TNCs as an alternative to the On-Call service. The pilot program uses Uber and Lyft to transport prequalified On-Call customers between an On-Call location and certain transit centers within a particular geographical area or to travel within a particular zone. To be eligible for the service, customers must download DART's GoPass mobile ticketing app and register to purchase a DART transit ticket. The TNCs provide trip information daily or monthly, which will help determine whether TNCs can replace the current On-Call service and be more cost effective.

To maximize travel for seniors, mobility-challenged customers, and those needing access to under-served areas, DART has also introduced an account-based taxi program in Plano, TX, a city in the DART service area. Senior and eligible mobility challenged customers can purchase up to \$100 in taxi services for 25 percent of the value. DART collaborated with the largest regional taxi provider to modify their digital dispatch software to accept the account-based cards. The system permits customers to pay DART with cash as well as with credit and debit cards, overcoming the restriction that some transit users are unbanked and do not have a credit or debit card. The account-based system also allows the transit system to collect important information on usage, passenger miles, and travel patterns, which is not possible with most credit card-based systems.

The account-based system also helps meet transportation needs in the Collin County area. A transit provider in the northeastern area of the Dallas-Ft. Worth region suffered financial setbacks and had to stop providing paratransit services to several communities located outside of the DART service area. DART used the technology platform and taxi model to introduce a service with per-trip costs of less than one-third the amount of the per-trip cost incurred by the service model it replaced.

Finally, DART is partnering with Zipcar, Uber, and Lyft to provide a more seamless experience. Users using the Dallas mobile app can click on one of the aforementioned providers and be directed to that provider's webpage.

Under a mobility-on-demand sandbox demonstration funded by the Federal Transit Administration, DART will create a mobile platform for multimodal trip planning and payment. DART will build on their account-based transit payment system to centralize billing across ride share, car share, bikeshare and other rural transit systems. DART will provide revenue settlement among all service providers, and will include services for customers without credit or bank accounts.

3.3 London, England

Transport for London (TfL), the government body that oversees the London transportation systems, was an early adopter of a common payment media—the Oyster contactless smart card. Oyster cards can be used on multiple forms of bus and rail transit conveyance.

Relatively soon after Oyster’s rollout, the Mayor of London, Ken Livingstone, announced that he wanted Oyster to become a method to pay for low-value purchases (e.g., food, drink, newspapers) at the nearly 4,000 shops that sold London bus and subway passes. However, United Kingdom financial regulations would have required TfL effectively to become a bank to accomplish this objective, so the idea never got off the ground.

Oyster has enjoyed widespread adoption and success; about 90 percent of transit transactions are made using the card. Regardless, TfL saw Oyster as an outdated business model in which one currency (the customer’s money) was exchanged for another (the TfL fare) that could only be used for a single purpose—paying for transit travel. TfL wanted to eliminate the need for customers to convert their currency to its currency in order to use TfL’s services.

In 2012, TfL introduced the capability for bus riders to use contactless bankcards to pay fares, and in 2014 this capability was extended to all other modes of transit travel operated by TfL, thereby creating perhaps the world’s largest contactless pay-as-you-go network. Visa-, Maestro-, MasterCard- and American Express-branded contactless credit or debit cards issued in the United Kingdom can be used.

TfL has now gone even further in its efforts to accept different forms of payment. Apple Pay and Android Pay can both be used to pay for transit trips. TfL has become the most popular merchant accepting Apple Pay in the United Kingdom. (TfL warns customers, however, to be consistent in their use of a single payment medium or risk being incorrectly charged an excessive fare or not receiving the benefit of fare capping.)

Lastly, TfL has developed an electronic "Journey Planner"—available on its website—which enables travelers to plan a trip using any form of public transport in London and by bicycle.

3.4 Los Angeles, CA

Los Angeles provides three instances of multimodal payment use:

- TAPForce
- Transit to bike share
- Go LA app

3.4.1 TAPForce – Los Angeles County MTA

The Los Angeles County Metropolitan Transportation Authority (LA Metro), the largest transit provider in the region, is also responsible for transportation planning and coordination in one of the nation’s most populous counties. LA Metro operates subway, light rail, bus, bus rapid transit, and Metro Express Lanes toll services. LA Metro also operates the TAP fare payment system (a contactless smart card system) and the FasTrak system (a transponder-based electronic toll collection system). LA Metro works closely with the other 26 bus and rail systems in the greater Los Angeles region, 22 of whom use the TAP system for fare collection.

LA Metro managers are planning to move to a multimodal mobility management approach. They are focused initially on the services they control directly: rail and bus transit. In addition, they are

implementing a bike share system. LA Metro has a relatively large technical staff, so they are able to develop customer management and trip planning software in house.

LA Metro has developed an online portal called TAP2Go, where customers can buy a new TAP contactless transit fare card, register a card, and add value to a card. They have leveraged their customer relationship management software, TAPForce, to create customer accounts. The TAPForce system is cloud-based and managed by in-house Metro staff. TAPForce records customer travel histories and TAP card usage information for both registered and unregistered cards.

LA Metro is planning to acquire a mobile trip planning app that they anticipate linking to mobile ticketing. Mobile NFC devices are currently not accepted at rail turnstiles, but LA Metro is considering installing readers on selected gates that can read mobile ticketing bar codes.

In the future, city management may support use of the TAP card for parking. Management is also considering offering the capability to add value to the TAP card at parking meters.

LA Metro is exploring unattended, ungated parking payment using license plate readers, and using the transit TAP card to identify transit riders. Future plans could use a multimodal purse in the customer's account to distinguish between transit and parking benefits.

3.4.2 Transit to Bike Share – Los Angeles County MTA

On June 25, 2015, LA Metro selected Bicycle Transit Systems, Inc. to launch a regional bike share program in Los Angeles County. Launch was targeted for July 2016 and initially includes approximately 1,100 bikes at 65 stations in downtown Los Angeles. The intent is to expand the system to Pasadena in 2017, as LA Metro plans to bring the program to eight other communities for a total of 4,000 bicycles in 10 communities in L.A. County.

The bike share program will use the TAP fare card⁶ to pay for and unlock bikes in the LA system as well as in the separate Santa Monica Breeze system. The bike share system will be account-based and will operate in parallel with the TAPForce transit account system. LA Metro will be able to link bike share account information to the TAPForce transit data. During the initial launch, transit payments and the two bike share systems will require separate accounts linked to the TAP card, but in later phases the system will become a single integrated system with the ability to share transit payment and bike share data. In the future, data on other modes may be added. Eventually, LA Metro could move to a system that is account-based by design. Differences in tax benefits among the modes will require separate accounting, however.

LA Metro has considered putting a TAP reader on the bike docking stations, but this may be too costly. Customers will probably be able to access a bike using their TAP account number.

3.4.3 Go LA App - City of Los Angeles

Launched on January 28, 2015, the Go LA App is a multimodal trip planning application that the City of Los Angeles is piloting with Xerox®. The Go LA App is envisioned as integrating every available method of getting around for consumers. The trip planning options will allow users to plan trips in the cheapest, fastest, or greenest way. In the initial launch, the app will allow users to plan travel and book and pay. In future, the app will roll out a scorecard to allow users to track usage, cost, and even fitness goals as

⁶ Dave Sotero, "Metro, City of L.A. to Launch Bike Sharing in Downtown L.A. on July 7," *The Source*, May 25, 2016. <http://thesource.metro.net/2016/05/25/metro-city-of-l-a-to-launch-bike-sharing-in-downtown-l-a-on-july-7/>

compared with their social media peers. A key goal of the Go LA app is to reduce the number of cars and present consumers with all of their mobility choices in one place.⁷

The app will be a common entry point for payment to Express Park, high-occupancy vehicle (HOV) payments, taxi, TNCs, public transit, and bike share and will redirect users to the service providers' apps.

3.5 Portland, OR

Portland is home to two multimodal payment examples:

- TriMet Tickets-RideTap SDK integration
- "Orange Marks the Spot"

3.5.1 TriMet Tickets-RideTap SDK Integration

Portland's TriMet Tickets, the official mobile ticketing app for Portland transit services, allows riders to buy and use fares for TriMet buses, Max Light Rail, and WES Commuter Rail directly from a smartphone. The TriMet Tickets app leverages RideTap⁸ to connect public transit riders to additional transportation options. Nearby ride options are integrated into the TriMet Tickets app, helping transit riders find and connect to additional ride options during transit service outages and for first- and last-mile solutions.

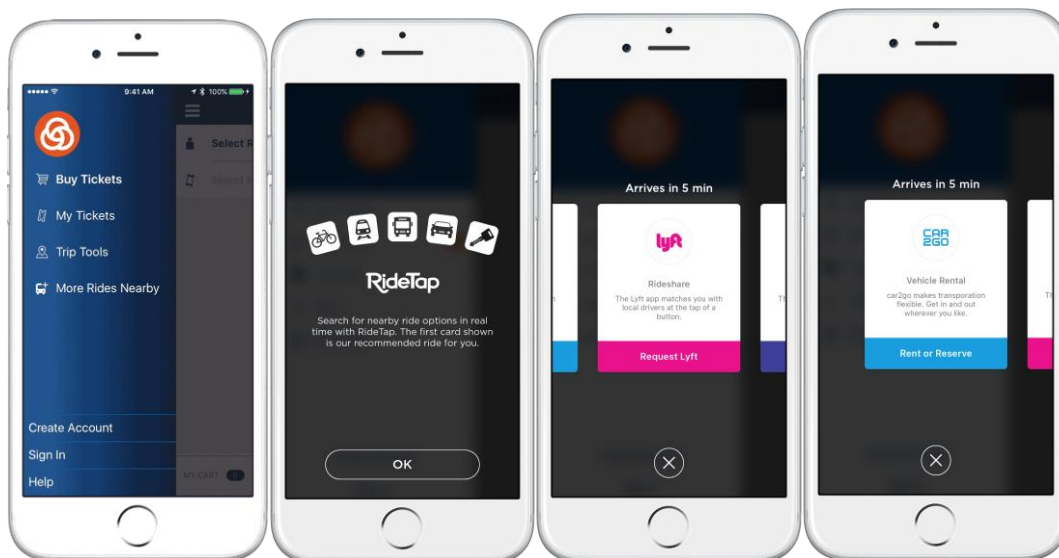


Figure 1. TriMet Tickets Integrated User Interface

Integration with RideTap was launched in Portland as a pilot in partnership with the Tri-County Metropolitan Transportation District of Oregon (TriMet), Lyft, and car2go. When users select the "More Rides Nearby" feature in the TriMet Tickets app, they are provided with real-time information about

⁷ According to Los Angeles Mayor Eric Garcetti, "The Go LA app will help Angelenos get where they want to go by connecting smart technology with infrastructure. Go LA gives users the opportunity to move around in smarter, faster, cheaper, and greener ways by linking them to all the transportation options available to them — from freeways to Metro to bike routes — while also providing the city with useful data to help us make policy decisions that benefit residents." Source: "Go LA App Provides Mobile Access to All Forms of Transportation," Mass Transit Magazine online, Jan. 28, 2016, http://www.masstransitmag.com/press_release/12163218/go-la-app-provides-mobile-access-to-all-forms-of-transportation.

⁸ RideTap is a software development kit (SDK) offered by moovel that provides any app instant access to a growing network of public and alternative transportation providers.

nearby rides from ride provider partners. Results are displayed in a ride card carousel (Figure 1), with the recommended ride option appearing first. App users can instantly access real-time information within the transit app and connect to a Lyft ride, car2go vehicle, Zipcar, or bicycle. (BIKETOWN, Portland's bike sharing system, was added in September 2016.)

3.5.2 “Orange Marks the Spot”

In September 2015, to celebrate the grand opening of TriMet's new Orange Line, TriMet launched a mobile scavenger hunt—Orange Marks the Spot—in partnership with mobile ticketing provider moovel transit (at that time, GlobeSherpa). The game was live for two weeks and was built into a new version of the TriMet Tickets mobile ticketing app for smartphones. In order to play, participants simply downloaded or updated the app.

Orange Marks the Spot used beacon technology. Small, fixed-location devices at participating retailers connected with smartphones using Bluetooth Low Energy. Nearly 100 businesses participated in the game. Participants could access the game at Orange Line stations by opening the TriMet Tickets app and tapping on the Orange Marks the Spot game. A map popped up indicating which nearby businesses were participating in the game.

When players approached a participating merchant, the beacon sent a notification to their phones. Swiping the notification automatically checked the player in at that spot. Coupons or special deals from the retailer would also pop up:

- Percent-off purchase discounts at restaurants and retail establishments
- Free coffee and cookie
- Free shoe rental (for bowling)

The game kept track of how many orange spots players discovered, qualifying them for daily drawings for prizes. All Orange Marks the Spot deals and prizes were donated by the participating businesses.

3.6 Raleigh, NC

Transloc is a provider of real-time transit information and trip planning. In March 2016, Transloc began a pilot program in Chapel Hill, NC, and Memphis, TN, to help people get to and from bus stops at the appropriate time. Transloc Rider includes a connection to Uber so that travelers can book rides for first- or last-mile coverage. The app, which is still being tested, connects travelers to their Uber account and books a ride; timing is based on the arrival of a bus. The app maker says that fare integration is not yet implemented, but that the future points in that direction.

3.7 Sacramento, CA

The Sacramento Area Council of Governments (SACOG) is an association of local governments in the six-county Sacramento, CA, area. A consortium composed of SACOG and transit agencies is working to implement a transit fare payment smart card system, the Connect Card, that will be used by at least nine Sacramento-area transit agencies. A governance structure is being developed to allow participation by non-transit smart card users, such as users who want to take advantage of bike share. The program is starting with an unadvertised “soft launch” with the region's largest transit agency, Sacramento Regional Transit (SRT), and will roll out to all agencies in 2017. The Connect Card system will offer online account management, various options for purchasing transit fares and passes, including automatic reload, cash value that can be used at any participating transit agency, and lost or stolen card replacement.

SACOG is also involved in the development of a bike share program covering three cities: Sacramento, West Sacramento, and Davis. The target timeframe for launch of the bike share program is spring or early summer 2017. Although the Connect Card is not yet in operation as a method of transit fare payment, SACOG would like the Connect Card to serve as an account identifier for its bike share program. Persons with a Connect Card would provide their card number to the bike share program, along with credit card information for payment of the bike rental fees. The Connect Card would also unlock the bike. These features of SACOG's contemplated bike share program are modeled on the bike share program already operating in Los Angeles; LA Metro's TAP transit fare payment smart card can be used to obtain (but not pay for) a bike (Section 3.4.2). Sacramento's bike share program also plans to vend Connect Cards from kiosks at bike share locations, enabling immediate use by someone without a smart card.

In early October 2016, SRT initiated an arrangement with Uber, Lyft, and Yellow Cab. A person using any of those three services to travel to or from any of six feeder stations in SRT's light rail network receives \$5 off the cost of the Uber, Lyft, or cab ride. The discount is obtained by entering a promotional code when reserving the ride using the service's app.

SRT has budgeted \$50,000 to reimburse the participating companies for revenue foregone because of the discounts. The program will continue for six months or 10,000 discount redemptions. SRT originally planned to offer the discounts only for rides taken on days when events occur at Sacramento's new downtown Golden 1 Arena, but the discounts are available every day. SRT's goal for the program is to encourage light rail usage by redirecting Uber, Lyft, and cab trips to the light rail stations.

3.8 Saint Petersburg, FL

The Pinellas Suncoast Transit Authority (PSTA) has partnered with Uber and United Taxi to help address a common barrier to use of public transit—getting to a public transit access point (the first mile/last mile issue). PSTA will pay half the cost of an Uber or United Taxi ride, up to \$3, for transportation to or from a PSTA transit hub. Uber has created a series of geofences around the pilot transit hubs, allowing Uber users to see a PSTA option in their Uber app when they start or end a trip near a PSTA transit hub. Consumers continue to pay Uber directly but at the discounted rate. Uber records the trip and provides documentation to PSTA, and PSTA provides Uber with funds monthly.

Under a mobility-on-demand sandbox demonstration funded by the Federal Transit Administration, PSTA will demonstrate a service to enable paratransit customers to call PSTA and arrange for on-demand transportation from transportation network companies. PSTA will use their credit merchant payment services vendor to provide service to customers without smart phones.

3.9 San Francisco Bay Area

Transportation in the San Francisco Bay Area includes three instances of multimodal payment convergence:

- Clipper® Card
- Mobile ticketing
- Carpool parking

3.9.1 Clipper Card

The Clipper electronic fare payment system, originally called TransLink, began operating in the San Francisco Bay Area in 2002 as one of the first contactless transit payment systems implemented in the United States. In 2010 TransLink was rebranded as Clipper, and participation increased dramatically.

3.9.1.1 CURRENT STATUS

Today Clipper is available to over 95 percent of all transit customers in the Bay Area; 20 agencies participate. On a typical day, Clipper processes over 800,000 boardings by cardholders; during a typical month, more than 900,000 unique Clipper cards are used.

The Clipper system currently supports over 100 fare products, calculates transfer discounts between agencies, and handles complex payment functions. The Clipper system processes a variety of partner transit-operator-specific fare policies, including flat fares on some services, distance-based fares on others, tap-in only with free exit, and tap-in/tap-out. A Clipper card can be used on every form of transit in the Bay Area—bus, light rail, heavy rail, commuter rail, ferry, and even San Francisco’s iconic cable cars.

Clipper’s only foray into a non-transit mode is a small pilot program in which a Clipper card can be used to pay for parking at a few municipal garages in San Francisco. To implement the pilot, Clipper technology was integrated into the current parking payment system in the garages. To use a Clipper card for parking, cardholders must set up and fund a parking “purse” that is separate from the transit funds on their card; the funds for transit and parking are separate because of the Clipper program’s interpretation of the Federal law on taxation of fringe benefits. Parking payments represent a small fraction of Clipper’s overall transactions (\$7,000 out of \$48 million in August 2016). There are no current plans to expand the pilot.

Clipper cards can also be used as an account identifier (but not for payment) for parking at BART’s rail stations.

3.9.1.2 POTENTIAL CLIPPER-FASTRAK INTEGRATION

In 2013, planning began for a next-generation electronic fare collection system (dubbed “C2”). A complete analysis determined which Clipper components are working well and which should be refreshed or redesigned. An example of a desired improvement is providing both transit riders and transit agencies with information and support in as close to real time as possible—a challenge in Clipper’s current card-based system. The probable switch under C2 to an account-based system may facilitate more and easier multimodal convergence for Clipper.

The Metropolitan Transportation Commission (MTC) is responsible not only for Clipper but also for electronic toll collection on the Bay Area’s toll bridges and lanes (under the FasTrak® brand). While both programs have similar operating requirements, the FasTrak and Clipper payment systems are currently delivered by different contractors at separate facilities, each serving the discrete needs of toll and fare payment customers.

The MTC has undertaken an analysis to see whether opportunities exist for consolidating infrastructure, resources, equipment, software, or services to deliver the FasTrak and Clipper programs more efficiently. The Clipper-FasTrak Convergence project is intended to answer the following questions:

- Which FasTrak and Clipper public services should be delivered as a single, consolidated service?
- Which system functions should remain independent?

The analysis was divided into two phases. A preliminary analysis identified and prioritized the consolidation opportunities, resulting in a list of viable consolidation options. An ongoing convergence analysis is identifying an approach to consolidating these components. Each area will be assessed for advantages, disadvantages, opportunities, and constraints. The results will enable MTC and program stakeholders to decide whether the Clipper and FasTrak programs should converge.

3.9.2 Mobile Ticketing

In November 2015, the San Francisco Municipal Railway (or Muni), launched the MuniMobile app in partnership with the software developer moovel transit (then GlobeSherpa). Customers can use the app to purchase, use, and save tickets on Muni buses, rail, cable cars, and SF Paratransit/SF Access.

MuniMobile lets customers buy tickets instantly using a credit or debit card or PayPal account. Tickets and passes can be purchased in advance or on-the-go. Tickets purchased in advance can be activated when users are ready to ride. Users can also use their smartphones to buy tickets for other people.

MuniMobile includes the following features:

- Ability to purchase, store, and use single or multiple Muni fares on one mobile device
- Ability to pay for single-ride fares, cable car rides, and one-day, three-day, and seven-day passports
- Industry-leading security to protect personal information and payments
- An e-commerce website for online ticket purchases

3.9.3 Carpool Parking

Under a mobility-on-demand sandbox demonstration funded by the Federal Transit Administration, BART and the Metropolitan Transportation Commission will demonstrate a seamless way to reserve and pay for carpool parking at BART transit facilities. BART and the MTC are working with Scoop Technologies, Inc. to tailor the parking app and allow customers to prepay the BART parking fee.

3.10 Toronto, CA

Metrolinx, an agency of the Government of Ontario, was created in 2006 to improve the coordination and integration of all modes of transportation in the Greater Toronto and Hamilton area (GTHA). In 2009, Metrolinx launched PRESTO, a contactless card-based electronic fare system used by 11 transit systems—10 systems in the GTHA and OC Transpo, the City of Ottawa's transit system. PRESTO can also be used on UP Express, the Metrolinx dedicated rail system connecting downtown Toronto's Union Station and Pearson International Airport.

PRESTO links regional rail services with local municipal bus, subway, and express rail services, creating a convenient and seamless travel experience across municipal boundaries and transportation modes using one fare card. The PRESTO e-fare system uses the latest fare technology, which can accommodate new transportation modes. PRESTO is also designed to be transferrable to other cities and transit systems, facilitating an interconnected network of seamless fare payment for transit riders.

In late 2016, PRESTO implemented a new payment method for paratransit vehicles. Making PRESTO available on board paratransit vehicles with a hand-held validator has been identified as a strategic priority for PRESTO and Metrolinx. Once this payment solution is implemented, PRESTO will be accepted as a form of payment on all transportation modes available in the GTHA and Ottawa regions.

PRESTO fare cards feature the latest and most secure DESFire® radio frequency chip technology, allowing users to pay by tapping a payment device. Customers can load their cards in person or remotely, by phone or over the PRESTO website. A flexible operating system allows participating transit systems to personalize fare structures and products. This open architecture balances the individual operating needs of participating transit agencies while ensuring an integrated and uniform payment system for public transit passengers.

To date, more than 8,000 PRESTO payment devices have been installed on buses and streetcars and at subway and train stations. PRESTO plans to install an additional 10,000 devices across the GTHA in the next two years to help meet demand from Toronto Transit Commission (TTC) expansion and provide additional payment points for public transit passengers.

PRESTO is flexible enough to accommodate the unique fare structures and passenger requirements of multiple transit agencies. The underlying technology is based on open standards, allowing for long-term sustainability and the ability to interoperate with new technologies as they emerge. The open architecture and interface standards also enable PRESTO to integrate unique device types from multiple vendors. PRESTO develops its own device software and runs a single application across multiple vendor devices and types. The PRESTO hardware processes transactions quickly, maximizing passenger throughput.

3.11 Washington, D.C. Area

Public transportation in Washington, D.C., operates under the auspices of the Washington Metropolitan Area Transit Authority (WMATA). WMATA operates Metrorail (the subway system) and Metrobus. In addition to administering public transportation, WMATA also manages and operates a regional program called SmartBenefits®. SmartBenefits implements a transportation subsidy program⁹ with which all Federal agencies must comply and is the D.C. area's most common form of transit benefit. Subsidies are available to commuters using any form of mass transit to travel to and from work, including van pools operated by private providers.

3.11.1 SmarTrip® Card

WMATA was the first large transit system to implement a regional payment smart card system, the SmarTrip card. The card can be used on WMATA subways and buses and on transportation administered by other transit agencies in the area. The Baltimore transit agency issues a compatible smart card.

The SmarTrip card is also the medium used by employers to provide SmartBenefits transit benefits. The benefits can be downloaded directly onto a SmarTrip card and can also be implemented as a virtual account that allows use of the funds at electronic systems that do not accept SmarTrip cards.

To implement the SmartBenefits subsidies to van pool commuters, WMATA currently issues paper vouchers but is beginning to phase out these vouchers and require these commuters to use the SmarTrip card. However, SmarTrip card readers are expensive, and without a partnership with WMATA and a capital subsidy for the equipment, installing SmarTrip readers is cost prohibitive for van pool

⁹ The transportation subsidy program is a program of financial incentives designed to encourage employees to use mass transit for commuting between work and home. The program originated with the Federal Employees Clean Air Incentives Act of 1993. In April 2000, Executive Order 13150 mandated that all Federal agencies in the National Capital Region implement a Transportation Subsidy Program by October 1, 2000. For more information, see [Transit Subsidy Benefit Program | U.S. Department of the Interior](#).

operators. In response, WMATA has set up a website that allows van pool riders to provide information about their van pool along with the code on the back of their SmarTrip card. WMATA then sends a monthly check to the van pool provider.

3.11.2 VRE Mobile

In May 2015, Virginia Railway Express introduced a free mobile ticketing app, called VRE Mobile. The app is integrated with WMATA's SmartBenefits program.

Using the VRE Mobile ticketing app, commuters can allocate SmartBenefits funds directly to the app to pay for transit with the pretax spending benefits provided by their employer. The VRE Mobile app is also integrated with Amtrak, providing interoperable mobile payment for VRE/Amtrak "step-up" tickets.

3.12 United States: National

In September 2016, Zipcar, one of the nation's largest car share providers, announced a partnership with bike share provider Zipbike to provide bundled car share and bike share services on university campuses across the United States.

According to the press release:¹⁰

Zipbike is the first national, sponsored mobility solution designed for universities. ZipBike bundles Zagster's proven bikeshare platform with Zipcar's popular university car sharing service to offer a single, simple solution to enhance a university's transportation network while reducing cost.

Zipbike helps campuses address transportation needs while reducing overall transit costs for both universities and students. By pairing shared bikes with shared cars, Zipbike offers a seamless way for students and staff to travel on and off campus.

The ZipBike app enables customers to book and pay for bike share and car share use. ZipBike is a national business-to-business partnership designed for universities.

3.13 United States: Regional

Electronic toll collection using transponders, rather than human toll collectors, has been the trend among toll agencies for the past three decades. But the number of different toll agencies in the United States poses a challenge for electronic toll collection: how to efficiently collect tolls from a driver going through multiple toll facilities.

To address this problem, in 1990 seven toll agencies in New York, New Jersey, and Pennsylvania formed the E-Z Pass Interagency Group (IAG). The IAG has since expanded to include 37 toll agencies in 16 states. The participating agencies agree to use the same toll collection technology and to exchange toll transaction data and reconcile collected tolls among themselves. Thus, a person with an E-Z Pass transponder can travel on toll roads and bridges from Maine to Illinois to Virginia using that single transponder.

Less extensive regional interoperability that relies on other toll collection technology has been achieved in other locations. SunPass has expanded beyond its Florida roots into Georgia and the Carolinas. The several toll agencies in Texas are interoperable. Similarly, the various toll facilities in California are

¹⁰ "zipcar and zagster launch zipbike, the first national, sponsored bike-share program for universities," press release, Sept. 16, 2016, <http://www.zipcar.com/press/releases/zipbike>

interoperable, and adopting a different toll collection protocol that would allow for interoperability with other Western states is under consideration.

The various electronic toll collection protocols in use in the United States do not necessarily communicate with each other, so a driver cannot currently travel anywhere in the U.S. and pay tolls electronically through deductions from a single account funded by that driver. The modified challenge for electronic toll collection becomes how to collect tolls efficiently from a driver going through multiple toll facilities in a single state or different states when each facility may use different technologies.

The Moving Ahead for Progress in the 21st Century Act, or MAP-21 for short, passed by Congress in 2012, requires national interoperability among U.S. toll agencies by October 1, 2016. Efforts to achieve national interoperability continue. Acknowledging this congressional mandate, the International Bridge, Tunnel and Turnpike Association (IBTTA), representing around 60 toll agencies in the U.S., has been a leader in the effort to bring about national tolling interoperability in an effective and affordable manner. According to IBTTA, the goal of national interoperability in the toll sector is to enable a traveler to pay tolls on any toll facility in the country using a single account.

The vendor community that serves the toll industry is also facilitating interoperability by offering multi-protocol transponders. Another approach is to share license plate information among toll agencies; this approach is especially appropriate for dealing with drivers who do not have a transponder in the car.

Realistically, however, national interoperability is still in the future. Among the significant issues that still need to be addressed, for example, is that choosing a single toll collection technology would penalize the toll agencies that have invested in a different but still-functioning technology.

4 Conclusion

Mobile and smart card technologies have provided new ways to make paying for travel more convenient. New transportation services have surfaced in many regions, and travelers expect “seamless” journeys on any mode of transportation. Mobile wallets have the potential to host transit-specific contactless cards not issued by a bank, especially in the context of account-based solutions. Account-based solutions even offer the potential for a unique “mobility ID” for an individual traveler recognized by transportation agencies across the country, regardless of the payment technology used by an agency.

While no single payment technology or approach has been adopted for every type of travel, several types of payments convergence are evident, including use of common payment technology, integrated or linked Web portals or mobile apps, integrated or linked payment accounts, and multimodal incentives. Several types of multimodal payments convergence have already been implemented or demonstrated in many regions.

While much progress has been made in payment integration, many challenges must be addressed to advance multimodal payments convergence. Technical issues must be addressed to support integration of mobile apps for different types of services, such as car share and bike share. Processes must be developed for handling payments and accounts involving multiple transportation providers. Institutional and governance issues must be addressed to determine how payment data will be shared among transportation providers, how new technology should be acquired and introduced, and how transportation incentives will be coordinated. While all transportation providers want to improve customer convenience, the business case and risks must be evaluated for specific payments convergence strategies on a case-by-case basis. The principles of equity and accessibility cannot be overlooked in the drive toward technological innovation.

These issues and their potential solutions will be discussed in the planned Part Two of this white paper: *Multimodal Payments Convergence: Challenges and Opportunities for Implementation*.

5 Publication Acknowledgements

This white paper was developed in collaboration between the Secure Technology Alliance Transportation Council and the Association for Commuter Transportation to explore the rapidly evolving convergence of multimodal payments.

Publication of this document by the Secure Technology Alliance or the Association for Commuter Transportation (ACT) does not imply the endorsement of any of the member organizations of the Alliance or ACT.

The Secure Technology Alliance wishes to thank Council members for their contributions. Participants involved in the development and review of this white paper included: Accenture; American Express; CH2M; Dallas Area Rapid Transit (DART); Discover Financial Services; Gemalto; Giesecke & Devrient; Incomm; INIT Innovations in Transportation; Kona I; LTK Engineering Services; NXP Semiconductors; Mastercard; Metropolitan Transportation Commission (MTC); Oberthur Technologies; Port Authority Transit Corporation; Southeastern Pennsylvania Transportation Authority (SEPTA); Thales Group; U.S. Department of Transportation (DOT)/Volpe Center; Vantiv; Waltz, Inc.

The Association for Commuter Transportation wishes to thank: moovel; PARC; RideAmigos; RideScout; Parking.org; SDG World; Shared Use Mobility Center.

The Secure Technology Alliance thanks Council members who participated in the project team to write the document, including:

- Randy Cochran, NXP Semiconductors
- Mike DeVitto, Waltz, Inc.
- Mike Dinning, U.S. DOT/Volpe Center
- Jerry Kane, SEPTA
- Carol Kuester, MTC
- Yannick Le Goff, Oberthur Technologies
- Celine Mantoux, Giesecke & Devrient
- Jane Matsumoto, Accenture
- John McGee, LTK Engineering Services
- Cathy Medich, Secure Technology Alliance
- Tina Morch-Pierre, DART
- Alan Poon, Accenture
- Craig Roberts, Incomm
- Brian Stein, CH2M
- Mike Strock, Secure Technology Alliance
- Minaoar Hossain Tanzil, Kona I
- David Weir, MTC
- Tim Weisenberger, U.S. DOT/Volpe Center
- Mike Wilson, Accenture

The Secure Technology Alliance thanks ACT members who participated in the project team to write the document, including:

- Regina Clewlow, moovel
- Larry Filler, ACT
- Chris Holmes, PARC
- Howard Jennings, Mobility Lab
- Collin Murphy, Shared Use Mobility Center
- Craig Nelson, SDG World
- Jason Pavluchuk, ACT
- Katie Sihler, RideScout
- Prachi Vakharia, Ride Amigos
- Rachel Yoka, International Parking Institute

The Secure Technology Alliance also thanks Council and ACT members who participated in the review of the white paper including:

- Huw Bailey, Discover Financial Services
- Francois Baylot, Thales Group
- David Bibby, Discover Financial Services
- Jen Dogin, Mastercard
- Gary Googins, LTK Engineering Services
- Michael Hughes, Vantiv
- Kathleen Imperatore, PATCO
- Jack Jania, Gemalto
- Rhonda Marx, American Express
- Bill McFarland, INIT Innovations in Transportation
- David Straus, ACT

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About the Secure Technology Alliance Transportation Council

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

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

The Transportation Council includes participants from across the smart card and transportation industry and is managed by a steering committee that includes a broad spectrum of industry leaders.

Transportation Council participation is open to any Secure Technology Alliance member who wishes to contribute to the Council projects. Additional information about the Transportation Council can be found at <https://www.securetechalliance.org/activities-councils-transportation/>

About the Association for Commuter Transportation

The Association for Commuter Transportation (ACT) is an international trade association and leading advocate for commuter transportation and transportation demand management. Commuting by bus, train, rideshare, bike, walking, or telework improves our world by contributing to energy independence, better air quality, sustainability, urban mobility, and reduced congestion. Our members include public sector transportation agencies, employers, universities, transportation management organizations, and mobility providers working together to expand options and improve our commute.

For more information, go to: www.actweb.org

6 Appendix A: Stakeholder Roles and Responsibilities

A variety of stakeholders with a variety of roles are involved in multimodal payment issues. Stakeholders can be categorized as operators, data integration service providers, and fare collection agents.

6.1 Operators

Operators are entities that provide transportation services. They can include both public and private providers. In many cases, operators have other roles as well, but their primary role is to provide service to the public.

A variety of entities can be characterized as operators.

6.1.1 Public Transit Agencies

Public transit agencies provide a variety of public transit services. The primary services include commuter rail, light rail, bus, van pools, connectors, and demand-response.

6.1.2 Private Contractors

Private contractors are private sector operators who provide transit services directly to the public and have a contractual agreement with a public entity. Both the type of entity and the extent of the contract can vary. In some cases, the private provider simply provides capital, while in other instances, the private entity acts as a public steward and provides services ranging from provision of capital to running the day-to-day operations of the service. Types of transit service provided include all of the items listed in the previous section.

6.1.3 Private Commuter Bus

Private commuter bus services are privately owned and operated services that are open to the public. Generally speaking, the service provides transit for long distance commuting (30+ miles one way). In some cases, there is a relationship between the private provider and a public steward whereby the public sector will provide a rider subsidy for service provided. In other cases, the service is provided without any formal relationship with the public sector. Users of commuter bus services are eligible to receive the transit benefit provided under section 132(f) of the tax code.

6.1.4 Private Van Pool Providers

Private van pool providers are much like private commuter bus operators. The primary difference is that van pools use 6–15 passenger vehicles and the driver is a volunteer from the group. Van pool riders are also eligible to receive the transit benefit provided under section 132(f) of the tax code.

6.1.5 Transportation Management Agencies/Circulators/Private Shuttle Providers

Transportation management agencies are regional coalitions of employers or other organizations that focus on providing transportation services to a specific set of commuters. For example, employers at a business park may join to offer combined commuter services. Or store owners at a mall may join to provide first mile/last mile connections for employees and consumers. These entities will often provide service in the form of circulators, shuttles, or streetcars and often require some minimal cash-based fare.

6.1.6 Car Share Provider

A car share provider is generally a private entity but in some cases, may be a nonprofit organization that provides access to a bank of cars for occasional use. Unlike the use of rental cars where a specific vehicle is reserved for a significant amount of time, car sharing is generally used for short trips.

There are several models of car sharing, including round-trip, point-to-point, and person-to-person car sharing. To use car sharing, one must be a member of the car share company.

6.1.7 Bike Share Provider

Bike share providers take three different forms: privately owned and operated, public-sector operated contracting with a private capital provider, or a public entity that contracts with a private provider for capital and operations. Much like car sharing, bike share is a short-term rental model. Unlike car share systems, bike share systems can typically be used without a subscription. However, rates and ease of service are typically better for those who have a subscription.

6.1.8 Ride Sharing

Ride sharing allows people to share the cost of a ride. There are two general types of ride sharing: dynamic ride sharing and ride sharing controlled by a transportation network company (TNC), also referred to as ride hailing or ride sourcing. The terms TNC, ride hailing, and ride sourcing are used interchangeably, but they refer to the same activity. The primary difference between dynamic ride sharing and TNCs is a profit incentive for drivers in the TNC model.

In this white paper, the distinction between these two types of ride sharing is insignificant.

6.1.9 Taxis

Taxis are a private commercial service that is often contracted to provide demand-response services as well as guaranteed ride home services. As TNCs become a larger part of mobility-on-demand, more taxi companies are providing resources to allow their services to be used to provide service that is similar to that provided by a TNC.

6.2 Data Integration

Data integration services include traveler information services, Web-based platform services, and smartphone app services.

6.2.1 Traveler Information

The traveler information data integration service is generally a publicly owned service that typically contracts with a private provider. Like 411, 511 is a toll-free phone number that people can call to get the latest information on traffic in a particular state or region. 511 programs are becoming more elaborate and are beginning to include Web-based features and transit and traveler information.

6.2.2 Web-Based Platforms

Web-based platform data integration services aggregate real-time traffic, transit, and mobility-on-demand information for display on a website or through a Web-connected application. Some services have created mobility dashboards that provide dedicated feeds of real-time transit and mobility-on-

demand information to be displayed in public areas or in the lobbies of commercial buildings, hotels, and apartments.

6.2.3 Smartphone App Services

Smartphone app services provide real-time information and trip planning through the app on a smartphone. Some trip planning apps are being linked to payment apps. Some local governments are creating apps for their region by partnering with a private sector provider, while some private providers distribute their apps nationally.

6.3 Fare Collection

The process of collecting fares includes three types of entities: the fare medium itself, and two human participants: technology providers and fare benefit providers.

6.3.1 Fare Medium

Fare media allow travelers to pay their fares. Currently, several media are available, and the industry continues to grow. Some of the more popular media include the following:

- **Tokens.** Travelers pay a set amount and receive a token that can only be used for a single trip on public transit. Tokens (and paper media) are becoming less prevalent.
- **Paper Voucher.** Travelers pay a set amount and receive a paper voucher with a stored value. Vouchers allow transit agencies to charge variable amounts based on such factors as distance, type of service used, and when service is provided.
- **Electronic Stored Media.** Contactless standards and protocols are used to ensure interoperability of contactless cards, devices, and readers, enabling transportation providers to accept many types of payment media.¹¹
- **Media Supporting Contactless Payment.** When the medium and reader allow contactless radio frequency communications, the card or other form factor (such as a key fob or NFC-enabled mobile device) must only be held in proximity to the reader to provide payment. Contactless fare media or NFC-enabled mobile devices are often used for bike share programs.
- **Probe Based.** Travelers do not pay directly as long as they are carrying a probe or other Bluetooth-enabled device. Very few agencies currently deploy this technology. A series of probes using Bluetooth technology can detect when a traveler is on a transit vehicle. The probe carried by the traveler can be a key fob or other form factor that is tied to an account.
- **Mobile Ticketing.** Mobile ticketing allows travelers to book and pay for trips using a Web- and or app-based account. The traveler is typically provided with a barcode, PIN, or some other mechanism to access the vehicle, bike, or ride. This is the primary fare collection mechanism used by car share providers and TNCs.

6.3.2 Technology Providers

Supporting the process of fare payment are multiple technology and other providers:

¹¹ "Reference Enterprise Architecture for Transit Open Payment System," Secure Technology Alliance Transportation Council, March 22, 2016, <http://www.securetechalliance.org/publications-reference-enterprise-architecture-for-transit-open-payment-system/>.

- Token/media kiosks
- Developers/programmers for smart cards and smart card readers, contactless cards and readers, and mobile ticketing
- Back office and accounting infrastructure development and software
- App developers and data Integrators

6.3.3 Transit Benefit Providers

Transit benefit providers are third-party entities who serve as middlemen between payroll providers or employers who provide the transit benefit to their employees and qualified public or private transit providers. The transit benefit provider serves as a sort of broker. They provide an employer or payroll provider with fare media or vouchers or electronic media that can be used to acquire fare media. Because of Internal Revenue Service regulations, the media that is provided must meet strict guidelines and can only be used for the purpose of commuting to and from work on a mass transit vehicle, van pool, or in limited circumstances, a bike.

7 Appendix B: Key Terms

This paper uses the following terms:

Contactless smart card. A plastic card with an integrated circuit chip that communicates with a reader through a radio frequency interface, usually through tapping the card on a designated area on the terminal.

First mile/last mile. Beginning or end of an individual trip usually made by public transportation.

Gamification. The introduction of elements of voluntary game play into non-game activities, such as competing for discounts and promotions, to encourage certain types of behavior.

Mobile payment. Payments made using a mobile device. Mobile devices may contain mobile wallets, emulate a contactless smart card or be used for mobile ticketing.

Mobile ticketing. A form of ticketing that allows users to book and pay for trips using Web or app-based accounts. Users generally receive a barcode, PIN, or some other identifier to access the vehicle, bike, or ride. Mobile ticketing is the primary mechanism used by car share and ride-sourcing services and is used on transit and commuter rail systems as a flash pass or with ticket validators.

Mobility-as-a-service. Arrangements in which a mobility manager supplies a variety of transportation services.

Mobility on demand. Transit, shared-use service, and transportation demand management projects and programs that connect users of a system with multimodal transportation options. Mobility on demand services often rely on smart-phone or Internet-based solutions to create dynamic and on-demand service.

Multimodal. The use of more than one mode of transportation in a journey. Modes may include driving a car, riding different types of transit, utilizing a bike-share or car-share program, ride sourcing, riding in a van pool, carpooling, or walking.

Open payments. Payment system that enables any bank, anywhere in the world, to link its customers (cardholders or merchants) with those of any other bank to transact business via payment cards almost instantaneously. This is also called a four-party system where the parties are the bank issuing cards, the merchant's bank that acquires the transaction, the merchant, and the cardholder who conducts the transaction and now must make payment in the case of credit or that made payment in the case of debit.

This type of payment system requires no contractual relationship between the merchants accepting the card for payment and the card issuer. Instead all card issuers and all merchant acquirers agree to abide by the rules and policies established and adopted by neutral third-party organizations. Visa and Mastercard are examples of third parties who set standards and policies for open payments. They neither issue cards nor accept or acquire transactions, yet the merchant accepting the card for payment is assured of getting their money, while the bank issuing the card must ensure it issues cards to consumers or companies that are able to pay for the transactions they conduct.

Paratransit. Services (usually door-to-door) provided in response to an individual customer's request. Also known as on-demand or demand-responsive transit.

Payment account. An account (such as an electronic toll account) to which users can deposit value and which are maintained remotely and debited as transportation services are used.

Payment media. The physical devices used to pay for or show proof of payment for goods or services. Payment media in transportation include cash, paper tickets, smart cards, mobile phones, and electronic toll tags.

Shared-use mobility. Transportation services that are shared among users, including traditional public transit, taxis and limos, bike sharing, car sharing, ride sharing, van pooling, transportation network companies, scooter sharing, shuttle services, and neighborhood jitneys.

Transportation network company (TNC). Companies such as Uber or Lyft™ that provide prearranged and on-demand transportation services for compensation, usually by connecting drivers of personal vehicles with passengers. Also, known as ride-hailing or ride-sourcing services.

Van pool. Group of individuals with a common schedule who generally live near each other and work in a common area and who band together to share a van for commuting.