FTA RESEARCH

FEDERAL TRANSIT ADMINISTRATION

Mobility Payment Integration: State-of-the-Practice Scan

U.S. Department of Transportation
Federal Transit Administration

Mobility Payment Integration: State-of-the-Practice Scan

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FTA Report No. 0143

PREPARED BY

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Metric Conversion Table

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
LENGTH				
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
VOLUME				
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liter	L
ft³	cubic feet	0.028	cubic meters	m³
yd³	cubic yards	0.765	cubic meters	m³
NOTE: volumes greater than 1000 L shall be shown in m³				
MASS				
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
TEMPERATURE (exact degrees)				
°F	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C

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This state-of-the-industry scan presents findings collected through an extensive literature search and an Internet inventory of deployments through January 2018. In addition, it conveys key implementation issues and potential solutions obtained through May 2018 in more than 20 FTA-led group and individual discussions with professionals from the public, private, and non-profit sectors that are currently engaged in mobility payment integration. The FTA MPI project team is iteratively developing an MPI demonstration and deployment planning framework (the MPI Framework) based on ongoing input from stakeholders engaged by the FTA MPI Program. This scan uses the MPI Framework structure to present the findings.

State of MPI Deployment in the U.S. as of January 2018

MPI is gaining momentum in the United States. As of January 2018, 34 locations around the country had deployed some variant of Automated Fare Collection (AFC) (see Table ES-1) in their transit systems; more have joined those ranks since then. "Mobility," as used by the MPI Program, includes conventional transit modes but extends the world of transit to encompass new forms of personal mobility that have emerged over the past decade: bikeshare, Transportation Network Companies (TNCs) (such as Uber and Lyft), and microtransit. Of these 34 locations with AFC deployments, 18—more than half—were in the process of advancing to MPI (Table ES 2). All of these systems had incorporated some combination of common (shared) payment media across the participating agencies and modes, created common or linked payment accounts for their customers, and used co-marketing and/or incentives. All offered a mobile app that was linked or integrated with mobility providers. Some of the identified MPI system locations were members of a group of 16 highly innovative demonstration projects in urban and rural settings that had been funded by the Federal Transit Administration (FTA) Mobility-on-Demand (MOD) Sandbox Program.

Challenges in MPI as of May 2018 and Opportunities to Resolve Them

Expanding the design attributes of transit payment systems that enable and constrain payment systems to encompass non-transit, largely private-sector providers of other mobility options introduces significant, complex issues in all dimensions of planning and operating an integrated payment system. The FTA MPI Program, with the support of the Volpe National Transportation

System Center, engaged professionals with experience in the rigors of bringing about MPI from the transit agency, integrator, financial payments, mobile app development, bikeshare, TNC, and microtransit sectors to share their perspectives. One vehicle for creating discussion was a series of Roundtables in which members of a given sector were brought together. The second vehicle is the FTA MPI Forum, a regular, ongoing teleconference for stakeholders on a variety of significant topics.

Many of the emergent MPI issues require—and, fortunately, lend themselves to—negotiated inter-provider agreements; others require technological solutions. The FTA MPI project team drafted the MPI Framework to serve as the focal point for discussing these issues and refining the collective understanding of their underlying causes. The goal is that with rolling refinement and correction coming out of the discussions, the Framework ultimately can be shared by FTA as a public resource.

Table ES-1

U.S. Locations with AFC Deployments as of January 2018

Location / Region	Program Name	Mobile App
Atlanta, GA	Breeze Card	
Chicago, IL	Ventra	×
Dallas, TX	GoPass	×
Southern FL	SFRTA/ Tri-Rail EASY Card, MDT EASY Card	
Los Angeles, CA	TAP	×
Maryland	CharmCard	
Boston, MA	Charlie Card	×
Milwaukee, WI	M-CARD	
New York City, NY	MetroCard	
New York/New Jersey	SmartLink Card	
Pittsburgh, PA	ConnectCard	
Portland, OR/Vancouver, WA	Hop Fastpass	×
Sacramento, CA	Connect Transit Card	
San Diego, CA	Compass Card / Compass Cloud app	×
San Francisco Bay, CA	Clipper Card / MuniMobile app	×
Seattle, WA region	ORCA Card / Transit Go Ticket app	×
Tampa Bay, FL	Flamingo Fares	×
Northern VA	VRE (Virginia Railway Express)	×
DC/MD/Northern VA	SmartTrip	
Austin, TX	CapMetro	×
Buffalo-Niagara, NY	Token Transit	
Houston, TX	METRO Q	×
Jacksonville, FL	STAR Card / MyJTA app	×
Minneapolis-St. Paul, MN	Metrotransit	
Palo Alto, CA	Bay Area Fair Value Commuting Demo Project	
Philadelphia, PA	SEPTA Key Card	
Philadelphia, PA and Southern NJ	Freedom Card	
Phoenix, AZ	Platinum Pass / Mobility Platform app	×
Pima County, AZ	AMORE pilot program	
San Antonio, TX	VIA goMobile ticketing	×
Spokane, WA	GO SmartCard	
St. Louis, MO	Gateway Card	
Tucson, AZ	SunGO Card	
Wasatch Front, UT*	FarePay (Utah Transit Authority)	

* On April 4, 2018, the Utah Transit Authority (UTA) announced that it would no longer accept Apple Pay, Google Pay, or contactless credit cards beginning April 8, 2018. Customers were encouraged to consider a Farepay card (40% off bus/20% off rail fare) or to download the UTA GoRide mobile payment app using Farepay or UTA's GoRide mobile payment app.

Table ES-2

U.S. Locations with AFC MPI Deployments as of January 2018

Metro Area	Common Payment Media across Multiple Modes	Mobile Payment Applications Linked or Integrated with Providers	Common or Linked Payment Accounts	Multimodal Incentives or Co-Marketing
Co-Marketing				
Austin, TX		o	o	
Boston, MA	×	o	×	×
Chicago, IL	×	×	×	
Dallas, TX	×	×	×	×
Houston, TX	×	×		
Jacksonville, FL	×	o		
Los Angeles, CA	×	o	×	×
New York, NY	×	o	o	
Philadelphia, PA	×	o	×	
Portland, OR	×	o		×
St. Petersburg, FL	×	×	×	×
San Francisco, CA	×	o	o	×
Salt Lake City, UT	×	×		
San Diego, CA		o	o	
Seattle, WA	×	o	o	
Tampa Bay, FL	×	o	o	
Twin Cities, MN	×	×		
Washington, DC	×	o	o	

x = deployed; o = planned

As the issues are refined and the performance characteristics of alternative approaches to addressing them become clearer, the FTA MPI Program intends to launch a second round of demonstration projects to test what facilitates MPI and what impedes its effectiveness. The demonstration projects in both rounds will undergo rigorous independent evaluation.

The overall issues, within the current logic of the draft Framework, group under four main topics: Planning, Policy, and Governance; Multimodal Payment Products and Architecture; Payment Settlement and Revenue Reconciliation; and Testing, Implementation, and Customer Service.

Planning, Policy, and Governance

With regard to **multimodal mobility service agreements**, transit operators are increasingly collaborating with non-transit shared-use mobility providers (carsharing, bikesharing, and ride-hailing TNCs) to provide first/last mile service, complement fixed-route rail or bus transit service, and improve accessibility

services for persons with disabilities and older adults in the community. The success of negotiating payment integration with these largely private-sector providers will be increased if public transit agencies understand other provider business models. Sharing data is a particularly sensitive issue for the private sector; to some degree, institutional arrangements and technological options may resolve their concerns. Of the three categories, TNCs present the greatest challenges; they also are moving ahead with their own initiatives in multimodalism.

Concerning **multimodal pricing policies, fare rules, and transfer agreements**, three main messages have emerged from participant discussions:

- *Simplifying fare structures within and among participating transit agencies is a best practice*—easier to explain to customers and less expensive to integrate. Technologically, there is virtually no limit to the number of business rules and system commands that a skilled integrator can include in the system, but they will increase the cost of the initial integration, raise operating costs, and may make changes to the system more complicated.
- *Fare capping is an equitable policy*, but it is difficult to explain to customers and requires a carefully planned campaign of customer education and ongoing customer support to succeed.
- *MPI may encourage extended (and more frequent) intermodal journeys by paratransit customers*, who have found the separate payment requirements of providers for various legs of a trip to be too confusing and too cumbersome; a single payment that can be settled at the back end is a highly desirable benefit of moving to MPI; however, managing the demands on the back end brought by IRS regulated employee benefits is complex and an integration challenge.

Concerning **acquisition and partnership strategies**, MPI calls for an approach that departs markedly from conventional transit procurement practices, because the product being procured—the development and continuous updating and maintenance of software—is profoundly different from vehicles, hardware, and buildings. The concept of software-as-a-service builds in the needed features, including the use of performance-based requirements, to provide the product; crafting the commercial relationship between the agencies and the integrator as a public-private partnership creates a mechanism that enables significant reduction in the agency's up-front capital outlay and uses performance standards to incentivize delivery of a consistently high quality of service.

Multimodal Payment Products and Architecture

The increasing sophistication and speed of mobile technologies for personal devices such as smart phones, smart watches, and fobs, coupled with the establishment of standards for the sharing of real time trip information, have provided the needed substrate for combining trip planning with trip payment—the heart of making MPI work for the traveling customer.

Payment Settlement and Revenue Reconciliation

The union of software-as-a-service and public-private partnership (P3) procurement approaches makes offloading the management of fare payment and settlement to the integrator a manageable risk with a high potential for accurate and timely performance. Ensuring data security and data privacy during payment processing is a significant issue.

Testing, Implementation, and Customer Service

Testing and implementing the system is prudently performed in stages that should start with a small pilot involving a selected group of customers who are representative of the riding public. With a partnership among modes and payment mechanisms, the delivery of effective customer service requires clear agreements beforehand regarding roles and responsibilities; it also requires resolution of what data sharing is essential to assuring satisfactory resolution of customer problems.

Five Cross-Cutting Issues Requiring Further FTA MPI Program Attention and Research as of May 2018

FTA MPI Forum participants agreed that finding consensus-based recommendations and/or performance standards for five pressing issues would greatly improve the efficiency and reduce the cost of MPI implementations and expansions.

Access to APIs and Need for Standardization

Application programming interfaces (APIs) are software that enable separate systems to interact and are the key to multi-system integration. There are two related themes—access to APIs (do agencies have to own APIs to use them effectively?) and API lack of standardization.

Data Rights and Need for Sharing

Data rights is currently a major issue that is not limited to the mobility sphere. At a societal level, the recent revelations concerning the depth of personal data captured by Internet companies (Facebook, Google, Amazon) and the monetization of those data for purposes that extend far beyond marketing in its traditional sense have raised profound concerns about personal privacy.

In the FTA MPI Forum and Roundtables, participants described how data sharing has been a concern for agencies, integrators, TNCs, and bikeshare providers. For example, the monetized value of customer data as a competitive tool to TNCs and bikeshare companies was seen as a security as well as privacy risk, as the personal data could be used to attract customers to one provider over another. Issues under this heading are the following:

- Who owns the data captured when an individual searches for trip options, makes a selection, pays for the trip, and completes the journey over multimodal segments?
- What boundaries should be set around uses of the data? Can the data be shared? Can it be sold?
- Which entities in the ecosystem need to have sensitive data shared with them for legitimate purposes?
- What are the legal and regulatory requirements for protection of customer privacy (Personally Identifiable Information [PII] and location data)?
- For data sharing to be recognized by the ecosystem as legitimate to occur, what information must the customer receive in advance, and what mechanisms for enabling the customer to give permission for data sharing should be specified as system requirements?

Customer Service

This issue has two dimensions: 1) roles and responsibilities, and 2) who has legitimate need for highly sensitive PII data to be shared with them?

Roles and Responsibilities

This issue was raised under a scenario in which a customer has paid for a joint ticket covering a multimodal journey. Whose problem is it if the customer buys a journey that includes bikeshare and then there is no bike waiting—whom should the customer call? Customers need to know from whom to seek support and how when something goes wrong with a leg in the multimodal journey they have paid for.

Who has Legitimate Need for Highly Sensitive Data?

To provide customer service, both transit agencies and financial institutions need highly-detailed trip information to resolve problems of this type. Both the identity of the individual making the payment for the trip and the individual's journey data indicating his/her location, sometimes down to a second in time, are considered PII.

Data Tokenization

At issue is how to maintain the security of PII data elements and preserve PII privacy while still being able to track the customer's identity in relation to the flow through the payment system. The technical solution, in progress, is tokenization.

Providing Service Equitably to All Customers

This was indicated by participants as the fifth most important issue. However, with two exceptions, it has received little discussion to date. Explicit discussion of participant experience and recommendations under this topic have been limited to:

- Discussion of how to assure under MPI that non-banked and underbanked customers have access to alternative means to be full consumers of an integrated, account-based system.
- Brief comment on the equitability of fare capping, as lower-income customers are more frequently compelled to pay by the ride because they do not have the funds at one time to take advantage of discounted weekly or monthly passes. With fare capping, they can pay as they go without exceeding what they should pay if registered for the pass.

These agencies are also legally and ethically responsible for providing services to special populations, including persons with disabilities (whether mobility-, visually-, or hearing-impaired). The population of older adults in need of accessible public transportation is ballooning with the aging of the "baby boomer" generation; the technical savviness, transit habits, and physical (as well as cognitive) capabilities of this cohort are different from those of millennials.

A major goal for the FTA MPI Program is to erase the bifurcation between special needs and other travelers. Every mobility system developed today has to address the needs of all riders—persons with disabilities, older adults, populations with income limitations, and those who live in transit-poor areas—not just urban, not just rural, not just feeder system; it all has to work together. There should be no distinguishing terms; it will be one mobility system.

FTA MPI Program Leadership for Mitigation

This scan, and the discussions that have informed it, reveal opportunities for productive action by the FTA MPI Program in the interest of advancing MPI.

Access to APIs

To some degree, the issues under this topic have their roots in AFC procurements that did not address the issue of access to, and use of, APIs.

Transit agencies seeking MPI services need to understand the software-as-a-service procurement and project management model and make use of P3 principles of risk sharing and incentivizing continuing quality performance. This approach includes due diligence practices for ensuring that the selected integration team is financially secure and stable.

The FTA MPI Program can play a leadership role in compiling and disseminating this key information. For example, recent procurements by the Massachusetts Bay Transportation Authority (MBTA) and the New York Metropolitan Transportation Authority (NYMTA) are representative of putting these principles to effective use to the benefit of the agency, its partners, and its customers. The procurement processes used by the two agencies could be documented in depth

and then distilled into a guidance document for dissemination by the FTA MPI Program.

API Lack of Standardization

Participants generally agreed that developing consensus on performance standards for APIs would save a tremendous amount of time for procurements and design and that the likelihood of future agency adoption of the MPI model would be increased. Participants supported the idea of the FTA MPI Program convening and facilitating discussion involving all the sectors toward this goal.

Data Rights and Sharing

General Opportunities

- What data are gathered? Are rights to the complete data set at issue in all instances? Explicit identification of which data are relevant to each dimension of the issue would bring improved clarity to the discussions.
- The idea of creating consensus on data consistency or even standards analogous to General Transit Feed Specification (GTFS) but for data and payment formats should be further explored.
- There are examples of systems in which attention to protecting the data privacy of individuals is going beyond privacy agreements in principle to defined technical solutions:
  - The multi-state EZ-Pass automated toll collection system separates account information from customer PII.
  - In its new Automated Fare Collection 2.0 (AFC 2.0) integration contract, the MBTA is decoupling account data and PII in a way that only the customer can re-link them.

The FTA MPI Program will continue to collect and disseminate best practices in MPI throughout the field to offer solutions to current and future challenges.

Provider-Integrator Issues

MPI participants believe that, under FTA auspices, they can jointly develop recommendations for general practices on data rights. As a representative from a major mobile payments consultant said, "There's agreement on MOST of the big issues. You can't sit down and have a frank discussion in the middle of a contract negotiation. It has to be outside this."

With recommendations on data rights as a basis for negotiation in place, data ownership issues between the agency and integrator may be resolvable through the procurement process using software-as-a-service and P3 models. The exemplar for this approach is the MBTA recent contract with Cubic for the AFC 2.0 project.

Data Rights Issues between Transit Agency and TNCs

The pilot experiences of Dallas Area Rapid Transit (DART), the MBTA, and other systems may be probed in detail to better understand the issues TNCs have with data sharing. One MOD Sandbox participant described a novel approach to the TNC data-sharing issue: creating "trusted partner" status for a private-sector intermediary between transit agency and TNC. This reportedly has been an effective solution in Europe.

More information is needed on the characteristics of the data to be transferred for the purpose of this demonstration project. A comparison of the parameters in this data set with those of the data set that a transit agency would want to support its operational and analytic purposes is needed; at issue is whether TNC willingness to share data in this specific situation can be generalized to a larger MPI context.

Customer Service

Under the aegis and organizational capabilities of the FTA MPI Program, it would be highly productive to gather participants across all sectors to develop consensus guidelines on what constitutes a legitimate need to have access to highly sensitive personal data to provide customer service.

As data privacy and security are topics receiving major attention in American society, the FTA MPI Program should also consider creating a forum for discussion among the members of the MPI ecosystem and members of the public whose data they are entrusted with. To come out of this:

- Consensus-based recommendations on creating opt-in rules so customers can opt-in, thereby giving their permission for access by entities and individuals with an approved need to know.
- Guidelines for all players in the MPI ecosystem on the information that must be provided to customers to enable them to understand the issues fully and make informed choices in their best interest.

Data Security and Tokenization

As noted, the privacy issue is critical in American society and globally. The FTA MPI Program can play a valuable role by convening cross-sector discussions intended to result in:

- Consensus on which entities and categories of individual have a justifiable requirement for access to customer PII.
- Consensus-based recommendations on creating rules so customers can opt-in, thereby giving their permission for access by entities and individuals with an approved need to know.

- Guidelines for all players in the MPI ecosystem on the information that must be provided to customers to enable them to understand the issues fully and make informed choices in their best interest.

The FTA MPI Program can work with the payments industry and EMVCo (Europay, MasterCard and Visa [EMV®]) on the availability of information that describes in simple lay terms how tokenization and PAR (Payment Account Reference) work. The objective of obtaining and disseminating this information is to help the public understand the techniques the industry is developing, and will continue to develop, to protect the privacy of its customers. They will then be equipped with the knowledge needed to decide whether they feel these protections are sufficient.

Providing Service Equitably to All Customers

Through selection of demonstration projects, the FTA MPI Program can seek innovative, effective service provision to travelers with specific needs. The insightful "lessons learned" shared by the MPI Forum and Roundtable participants on the complexities and challenges of the "gift card" model are important to share with agencies and planning organizations considering MPI. In cooperation with the American Public Transportation Association (APTA), the FTA MPI Program team could convene a panel at an APTA event on this topic.

Introduction

All transit is local. That is, the transit systems in a given location have a structure and modal composition today that have their roots in an original system intended to meet local needs and conditions. Current elements have evolved as those factors changed, making use of the technologies and infrastructure capabilities available at various times.

In the beginning, fares were paid with cash or tokens. However, in the past 25 years, fare payment media have advanced exponentially, from paper cards with magnetic strips to contactless smart cards and mobile applications on smart phones and wearables. At the same time, the rise of on-line communications has enabled a revolution in how the back-end operations associated with fare management are performed, and by whom.

Enabled by the explosive advances in smart phones, wireless technology, and near-field communications, the notion of transit has morphed into the idea of personal mobility, presenting non-conventional travel options that include bikeshare, rideshare, microtransit, and ride hailing provided by Transportation Network Companies (TNCs) (Uber, Lyft). The development of on-line, multimodal travel planning applications and GPS-enabled real-time locational tracking of transit vehicles has been essential to this evolution.

Although transit agencies must tailor their payment systems to meet regional situations and needs, open payment media and mobile applications are being deployed on a national level. Open, account-based architectures are being implemented that make it easier for these payment methods to be adapted to meet differing local needs. Large urban centers in regions with relatively dense regional populations have been in the vanguard of these innovations; other, smaller regions with less extensive transit systems have followed, initially with upgrades to conventional transit, but most recently with the addition of non-conventional options. The populations of rural areas also have a need for transportation connectivity and mobility, and local governments, community services, and state/regional transportation agencies have started to innovate via public-private partnerships with TNCs to provide microtransit as well as ride-hailing options in the absence of conventional transit options.

There are approximately 6,800 transit systems in the U.S. (Table 1-1). Most are small, providing fixed-route bus service to rural and limited suburban and urban areas, and most are operated on a cash/fare box payment system.

Table 1-1

Estimated Number of Operating Public Transportation Systems in U.S. by Mode as of 2014

Mode	Urbanized Areas[a]	Rural[a, b]	Non-Profit Providers[c]	Total
Aerial Tramway	2	1	0	3
Automated Guideway Transit	7	0	0	7
Bus	700	439	0	1,139
Bus Rapid Transit	10	1	0	11
Cable Car	1	0	0	1
Commuter Bus	120	158[d]	0	278
Commuter Rail	27	0	0	27
Demand-Response[e]	688	1,092	4,586	6,366
Ferry Boat	34	7	0	41
Heavy Rail	15	0	0	15
Hybrid Rail	5	0	0	5
Inclined Plane	4	0	0	4
Light Rail	23	0	0	23
Monorail	2	0	0	2
Publico	1	0	0	1
Streetcar	11	0	0	11
Transit Vanpool	78	21	0	99
Trollybus	5	0	0	5
Total[f]	*820*	*1,383*	*4,586*	*6,792*

NOTE: Total in bottom right cell is not the sum of modes by location because many systems operate more than one mode.
[a]Some urban providers operate services into surrounding rural areas, and some rural providers operate service into nearby urbanized areas.
[b]Rural includes Indian tribal services.
[c]May be either urbanized area or rural.
[d]Includes rural transit intercity bus service.
[e]Includes non-profit providers of service to seniors and persons with disabilities, and demand response taxi service.
[f]Total is not sum of modes because many providers operate more than one mode.

The pressures driving system enhancement come from both outside and inside the system. Externally, demographic shifts and changes in the geographic and sometimes socioeconomic distribution of the population have resulted in a changed set of needs and conditions. At the same time, accelerating technological advances and burgeoning data connectivity have resulted in altered expectations with respect to personal mobility.

The traditional model of public transit is to get a lot of people into a vehicle that's going to one place at one time, on a set schedule, and according to a pattern. Today, though, we're used to things being on demand. So developing around the traditional urban infrastructure are a whole variety of nontraditional means of mobility, such as carsharing and bikesharing. In what I'll call the "Mad Men" days of commuting, you commuted to work one way, and you went back the same way, and the pattern was very symmetrical. Now, travel is becoming asymmetrical. You take a

whole series of different modes across the day—a train, a bus, an Uber ride, bikeshare, walking, a ferry. – *Jay Walder, CEO of Motivate, August 2016[1]*

As of January 2018, 34 locations had adopted some form of automated fare collection (AFC) for their transit systems. Those systems were predominantly located in larger urban and regional areas and operated by either single agencies or multiple agencies in coordination. Closed-loop payment systems (proprietary payment systems) were the predominant typology among those agencies. A total of 18 of those locations had advanced to some degree of mobility payment integration.

With the advent of new technology, closed-loop systems are now considered to be more expensive and limiting in comparison to the new open-payment systems.[2] Proprietary systems leave transit agencies beholden to one vendor for everything related to the technology, including upgrades and added functionality. In contrast, standards-based systems enable transit operators to invest in communication and payment technologies that are based on open standards and widely deployed across industries. This gives agencies the freedom to make changes and upgrade their systems as the needs of the region they serve change.[3]

Many transit agencies are replacing card-based proprietary systems with account-based open systems. Account-based systems enable transit agencies to more easily change fare rules and to accept a variety of payment media. 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 County Metropolitan Transportation Authority (LACMTA) is leveraging its customer relationship management system to create transit customer accounts for LACMTA that can be extended to pay for bikeshare.

In recent years, the technology and processes for integrated, open-standard, contactless bankcard (i.e., credit or debit card issued commonly by financial institutions) payment systems have reached the point where they can meet the financial needs of transit systems.[4] Agencies can transition from managing the entire payment operation to simply being another merchant in an account-based

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[1]McKinsey and Company, "Rolling Along: Bicycles, Mobility, and the Future of Cities," interview, August 2016, https://www.mckinsey.com/business-functions/sustainability-and-resource-productivity/our-insights/rolling-along-bicycles-mobility-and-the-future-of-cities, accessed 5/13/2018.

[2]"Open Bank Card Fare Payment Systems: High Value Potential," October 1, 2011, *Global Mass Transit Report*, http://www.globalmasstransit.net/archive.php?id=7974, accessed 2/7/2018.

[3]Jill Jaracz, "Open-Loop Transit on the Rise: Agencies Want to Save Money Using Standard Payment Cards," June 6, 2012, *SecureIDNews*, https://www.secureidnews.com/news-item/open-loop-transit-on-the-rise/, accessed 2/7/2018.

[4]*Ibid.*

system, a potentially large cost savings.[5] To accommodate customers without bank cards, transit agencies are also accepting pre-paid cards, onto which customers can purchase and load value at retail stores or vending machines.

For a typical multimodal journey, however, travelers must use several different types of payment media. Many transit authorities are demonstrating and implementing innovative approaches to integrate payment methods for different types of mobility. To this end, mobile trip planning, payment, and ticketing in various combinations have been implemented by a number of transit agencies.

At the request of the FTA MPI Program, the Volpe National Transportation System Center (Volpe Center) conducted a scan to assess the extent of MPI planning and deployment to identify common deployment experiences and trends and key issues requiring resolution if MPI is to move ahead to provide maximum benefit. Thus, because all transit is local, the scan sought expected commonalities in the features of these advanced systems as well as the choices that transit agencies and their partners made to create a system that could best fit the needs of their customers in their respective area(s).

This scan is a snapshot of MPI deployments as of January 2018 and of cross-cutting challenges, lessons learned, and the most pressing policy and technical issues as of the end of May 2018. Because the technology driving MPI is in a state of continuous evolution and transit agencies are migrating toward MPI at an accelerating pace, FTA anticipates updating this document periodically.

The remainder of this report is organized as follows:
- Section 2 – Methods
- Section 3 – Findings: Inventory
- Section 4 – Findings: Challenges and Trends in MPI as of May 2018
- Section 5 – Findings: Five Cross-Cutting Issues Requiring Further FTA MPI Program Attention and Research as of May 2018

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[5]*Ibid.*

Methods

The information presented in this report was collected through an extensive literature search, an Internet inventory of deployments, and more than 20 group and individual discussions with professionals from the public, private, and non-profit sectors who are currently engaged in mobility payment integration.

Literature Search

There is substantial documentation from the past 20 years produced by the Transportation Research Board's Transit Cooperative Research Program (TCRP); the Smart Card Alliance (SCA, now the Secure Technology Alliance [STA]); the American Public Transportation Association (APTA), in the form of presentations at its annual Payment Summits; and numerous other sources. Much of the content addressed the evolution of AFC, the technological advances that made AFC possible, and lessons learned from implementations. Literature specific to the expansion of AFC into MPI is more recent and less abundant. Because MPI has been implemented for some years now in Europe and Asia and is only now gaining acceptance and implementation in the U.S., the available literature, in addition to the most recent STA white papers and APTA presentations, tend to be in the form of the written products of private-sector vendors (e.g., integrators, smart phone app developers), trade publications associated with public transit and bikeshare, and, importantly, records and reports from the implementing U.S. transit agencies.

Inventory of Deployment Locations

The next step was to identify the cities and regions in the U.S. that had implemented AFC and/or mobility payment integration. A table prepared by Okunieff (2017)[6] was the starting point for the inventory. The information contained in it was verified by assessing each transit agency's current website and doing further searching as needed. The range of agencies was then expanded, adding locations mentioned in the literature or identified via Internet search.

Similarly, a table presented in STA (2017)[7] was adapted and expanded to list those U.S. locations with MPI-directed deployments (i.e., involving some combination of unified payment media, linked or integrated mobile applications, common or linked payment accounts, and offering multimodal incentives or engaging in co-marketing).

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[6]P. Okunieff, TCRP Synthesis 125: "Multiagency Electronic Fare Payment Systems," Transportation Research Board of the National Academies, Washington, DC, 2017, Table C1, Smart Card Timeline, pp. 116-118.

[7]Secure Technology Alliance, "Multimodal Payments Convergence—Part One: Emerging Models and Use Cases, Version 1.0," March 2017, Table 1, pp. 10-14.

Connection with Stakeholders to Surface Challenges and Key Issues

Obtaining first-hand reports of the experience of the transit agencies and metropolitan planning organizations (MPOs) that have engaged in these deployments was recognized as essential for the success of the FTA MPI Program. This was equally true for the private-sector providers (microtransit, TNCs, and bikeshare) with whom they were seeking to integrate payment systems and coordinate services. Likewise, engaging the integrators, payments industry, and enabling-technology vendors and consultants was a necessity.

Volpe collaborated with FTA on a preliminary contact list of prospective participants. This list drew upon the inventory of deploying locations, membership of the APTA Fare Collection Systems Committee and Secure Technology Alliance Transportation Council, knowledge of known private-sector entities in the various sectors, and personal contacts made by the combined FTA–Volpe MPI project team at conferences. That list was (and will be) continually expanded as new participants are identified or make themselves known. The efforts to engage them were in parallel—one individually targeted to each MPI stakeholder sector, the other engaging the sectors collectively.

Roundtables

A series of FTA MPI Roundtables was planned to gather members of an individual sector (payments industry, integrators, transit agencies, TNCs, and microtransit, bikeshare, and enabling-tech vendors) to candidly discuss in detail their experiences, observations, and issues. These were to take place either in person or via teleconference. In some additional instances, the FTA MPI project team met with an individual member of a particular sector.

At each Roundtable, participant(s) were asked to describe what they do and their experiences with MPI deployments. In addition, the FTA MPI project team described the FTA MPI Program and its emphasis on demonstration projects, and participants were asked about their interest in playing a part in contributing to the achievement of Program objectives. In every case, the response was affirmative and positive.

Forums

The FTA MPI Forums are an ongoing series of teleconferences. All stakeholder contacts from all sectors are invited, creating a unique opportunity for the separate interests in MPI deployments to hear one another's experiences, issues, viewpoints, and underlying concerns. Starting in December 2017, the Forums were convened monthly; by the end of April 2018, Forum participants had identified a limited number of critical issues for further discussion, and the teleconference schedule was revised to biweekly sessions.

Table 2-1 presents a summary list of the dates of Roundtable and Forum events through May 2018 that produced comments captured in this scan. Both continued after this date.

Table 2-1

FTA MPI Roundtables and Forums Captured in 2018 Scan

Date	Stakeholder or Sector	Meeting Type	Meeting Type
Roundtables			
14 Nov 2017	LA Metro	Individual	Teleconference
4-Dec 2017	MBTA	Individual	Meeting
1-Mar 2018	Bank cards	Group	Meeting
7 Mar 2018	TNCs	Group	Teleconference
8-Mar 2018	MasterCard	Individual	Teleconference
9-Mar 2018	Cubic	Individual	Meeting
20-Mar 2018	Transit agencies	Group	Teleconference
21-Mar 2018	Masabi	Individual	Teleconference
23-Mar 2018	Google Mobile Payments	Individual	Teleconference
2-Apr 2018	Conduent	Individual	Teleconference
4-Apr 2018	Bytemark	Individual	Teleconference
5-Apr 2018	Integrators	Group	Teleconference
12-Apr 2018	Ford Chariot	Individual	Teleconference
13-Apr 2018	MBTA	Individual	Teleconference
25-Apr 2018	Bikeshare	Group	Teleconference
8-May 2018	Actminds	Individual	Teleconference
15-May 2018	Visa	Individual	Teleconference
Forums			
18-Dec 2017	# 1 – Kickoff		
29-Jan 2018	# 2 – Orientation		
26-Feb 2018	# 3 – Framework		
26-Mar 2018	# 4 – Framework		
23-Apr 2018	# 5 – Framework		
8-May 2018	# 6 – APIs		
22 May 2018	#7 – Data Sharing		

Participants say that they have found these Forum discussions to be productive and valuable. The Forums are planned to continue on a regular basis, inasmuch as the expanded deployment of MPI, continuing evolution of supporting technologies, and emergence of policy issues over time ensure that having cross-sectoral discussion and potential consensus building may contribute substantially to the success of FTA in achieving its goals for the FTA MPI Program.

The findings reported in the remainder of this report are the result of the inventory, literature search, and discussions with stakeholders at the Roundtables and Forums. Some of the information and observations, particularly with respect to planning and policy, are not unique to mobility payment integration.

In our view, however, they are not only germane, but integral to a transit agency or regional planning organization's due diligence in considering, shaping, procuring, and implementing an integrated mobility payment system.

Findings: Inventory

AFC Implementation as of January 2018

The results of the search for locations with at least AFC systems as of January 2018 are shown in Table 3-1, comprising deployments in 34 U.S. locations. Some locations have systems that include some use of a mobile app, often for transit travel information.

Table 3-1

U.S. Locations with AFC Deployments as of January 2018

Location / Region	Program Name	Mobile App
Atlanta, GA	Breeze Card	
Chicago, IL	Ventra	x
Dallas, TX	GoPass	x
Southern FL	SFRTA/ Tri-Rail EASY Card, MDT EASY Card	
Los Angeles, CA	TAP	x
Baltimore, MD	CharmCard	
Boston, MA	Charlie Card	x
Milwaukee, WI	M-CARD	
New York City, NY	MetroCard	
New York/New Jersey	SmartLink Card	
Pittsburgh, PA	ConnectCard	
Portland, OR/Vancouver, WA	Hop Fastpass	x
Sacramento, CA	Connect Transit Card	
San Diego, CA	Compass Card / Compass Cloud app	x
San Francisco Bay, CA	Clipper Card / MuniMobile app	x
Seattle, WA region	ORCA Card / Transit Go Ticket app	x
Tampa Bay, FL	Flamingo Fares	x
Northern VA	VRE (Virginia Railway Express)	x
DC/MD/Northern VA	SmartTrip	
Austin, TX	CapMetro	x
Buffalo–Niagara, NY	TBD	
Houston, TX	METRO Q	x
Jacksonville, FL	STAR Card / MyJTA app	x
Minneapolis–St. Paul, MN	Metrotransit	
Palo Alto, CA	Bay Area Fair Value Commuting Demo Project	

Table 3-1 (cont.)

U.S. AFC Deployments as of January 2018

Location / Region	Program Name	Mobile App
Philadelphia, PA	SEPTA Key Card	
Philadelphia and Southern NJ	Freedom Card	
Phoenix, AZ	Platinum Pass / Mobility Platform app	x
Pima County, AZ	AMORE Pilot Program	
San Antonio, TX	VIA goMobile Ticketing	x
Spokane, WA	GO SmartCard	
St. Louis, MO	Gateway Card	
Tucson, AZ	SunGO Card	
Wasatch Front, UT	FarePay	

Locations with MPI Implementation as of January 2018

Although specific details vary according to the needs of the locality, an integrated mobility payment system must have certain key attributes. The first is that the system must be multimodal; four additional attributes that characterize systems with MPI are that they have some combination of 1) common payment media across the participating agencies, providers, and modes, 2) mobile applications that are linked or integrated with the mobility providers, 3) common or linked payment accounts, and/or 4) the use of multimodal incentives or co-marketing to build ridership.

The 18 intermodal systems identified as of January 2018 with one or more of the additional characteristic MPI attributes are presented in summary form in Table 3-2.

Table 3-2

U.S. Locations with MPI Deployments as of January 2018

Metro Area	Common Payment Media across Multiple Modes	Mobile Payment Applications Linked or Integrated with Providers	Common or Linked Payment Accounts	Multi-Modal Incentives or Co-Marketing
Austin, TX		o	o	
Boston, MA	x	o	x	x
Chicago, IL	x	x	x	
Dallas, TX	x	x	x	x
Houston, TX	x	x		
Jacksonville, FL	x	o		
Los Angeles, CA	x	o	x	x
New York, NY	x	o	o	
Philadelphia, PA	x	o	x	
Portland, OR	x	o		x
St. Petersburg, FL	x	x	x	x
San Francisco, CA	x	o	o	x
Salt Lake City, UT	x	x		
San Diego, CA		o	o	
Seattle, WA	x	o	o	
Tampa Bay, FL	x	o	o	
Twin Cities, MN	x	x		
Washington, DC	x	o	o	

x = deployed; o = planned

Key Elements of Identified MPI Implementations

As noted, there were four types of payment integration that the multimodal systems listed in Table 3-2 had implemented:

- Use of a shared payment technology (payment integration and/or payment medium)
- Integrated or linked mobile apps
- Common or linked payment accounts
- Multimodal incentives or co-marketing

Use of a Shared Payment Technology

Shared payment systems allow customers to use the same card or app to pay for transportation on subways, light rail, buses, or ferries administered by different

transit agencies in a region, as well as for travel on non-transit modes such as bikesharing and ride hailing.

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 also accept payment cards issued by other organizations, such as banks, and prepaid cards. 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 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 bikeshare, carshare, or ride-hailing, has not been widespread because it is often difficult to use this form factor on these systems. Bikeshare systems can accept transit smart cards if smart card reader technology is incorporated into the bike docking station.[8]

Integrated or Linked 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 carshare and bikeshare 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.

Software developers have created software development kits (SDKs) and open application programming interfaces (APIs) to facilitate linking different public and private organization trip planning, booking, and payment apps. 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. 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.

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[8]A demonstration in Chicago developed a special hybrid smart card with two chips that could be used to access a carshare 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.

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 provider apps, which are used to book and pay for the trip. Transit apps have been linked to bikesharing apps in some areas.

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 a number of American cities. For example, a traveler's account in the Chicago Transit Authority's 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. 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.

Another example is the new technology being installed across LACMTA's system that will allow the Los Angeles commuter rail system (Metrolink) riders to use their mobile app to transfer to the gated Metro Rail (subway) system. The installation and testing of these new optic readers will continue throughout 2018. Approximately 30% of Metrolink riders transfer to Metro Rail. At present, Metrolink riders who transfer to Metro Rail cannot use an electronic ticket, but must use a TAP-enabled[9] paper ticket to access Metro Rail. This means commuter rail riders have to get to the train station in time to wait in line at the ticket vending machine to purchase the paper ticket before boarding their subway train. This new technology will help Metrolink riders make a seamless transfer to Metro rail, getting them to their destination sooner.[10]

In the mobility-as-a-service (MaaS) approach, a mobility manager provides travelers with a multimodal mobility account. This approach allows travelers to use a mobility account to pay for any type of transportation service. The traveler

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[9]Metrolink has been using paper tickets for transfers, not plastic TAP cards. For Metrolink passengers to get through latched gates, Metrolink and Metro worked together to develop paper TAP cards for Metrolink customers. http://thesource.metro.net/2013/05/13/metrolink-posts-details-on-tap-enabled-tickets-for-its-customers/, accessed 5/14/2018.

[10]A. Chen, "Optic Gate Scanners Will Allow Metrolink Mobile Ticket Holders to Transfer to Metro Rail," 12/28/2017, https://thesource.metro.net/2017/12/28/optic-gate-scanners-will-allow-metrolink-mobile-ticket-holders-to-transfer-to-metro-rail/, accessed 5/14/2018.

has an account with a regional mobility manager, which collects payments, arranges services, and reimburses service providers as part of a payment settlement process. 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.

Multimodal mobility accounts have already been demonstrated in European countries. In Europe, the MaaS Alliance is a public-private partnership creating the foundation for a common approach to MaaS, unlocking the economies of scale needed for successful implementation of MaaS in Europe and beyond. The main goal is to facilitate a single, open market and full deployment of MaaS services.[11] Multimodal MaaS demonstration systems were very popular when tested in Finland and Sweden and appeared to encourage non-automobile travel. Several regions in North America have considered the idea of a universal travel or mobility account; however, numerous details related to governance and the business model must be resolved before MaaS can be implemented broadly in the U.S.

Multimodal Incentives or Co-Marketing

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. Incentives can also be used to influence travel behavior based on regional transportation conditions. In Washington, DC, for example, ride-sourcing, carsharing and bikesharing, and parking companies provided discounts to customers during an extended maintenance program on the subway system.

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. For example, Portland's transit agency, Tri-County Metropolitan Transportation District of Oregon (TriMet), 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.

Many transit agencies are now co-marketing with transportation service providers who complement their services. Transit agencies may allow shared-use mobility providers such as carshare, bikeshare, and ride-sourcing companies to

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[11] https://maas-alliance.eu/.

market their services on the transit agency's website or mobile app. Often, this marketing includes discounts to incentivize the use of shared-use services to reach transit.

Discounts also may be offered by retail outlets or service providers or at events in areas served by transit. The intent of offering these incentives is to help increase sales and transit use, contributing 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 bikesharing.

Findings: Challenges and Trends in MPI as of May 2018

This section presents the findings obtained from the literature search and the discussions and lessons learned obtained during the MPI Program's Forum and Roundtable stakeholder discussions. It is organized around the main issue areas that are outlined in the MPI Framework.

The FTA MPI project team is iteratively developing an MPI demonstration and deployment planning framework (the MPI Framework) based on ongoing input from stakeholders engaged by the FTA MPI program. This scan uses the MPI Framework structure to present the findings. The organizing topics of the MPI Framework at the time of this report's completion, all of which are cross-cutting challenges, are:

- Planning, Policy, and Governance
- Multimodal Payment Products and Architecture
- Payment Settlement and Revenue Reconciliation
- Testing, Implementation, and Customer Service

A living document, the MPI Framework intended to serve as a resource to the MPI community; a set of lessons learned for their systematic, efficient, and comprehensive process for planning, procuring, and implementing mobility payment integration.

Planning, Policy, and Governance
Multimodal Mobility Service Agreements
Integration with Traditional Transit Providers

One of the most essential activities associated with integrating payment across conventional transit providers is the alignment of business rules covering roles and responsibilities, fare structures, and other operational considerations. These negotiations have been time-consuming but must be addressed before procurement, as these agreements—part of the system's Concept of Operations— drive the functional and technical requirements specified in the Request for Proposal.

Integration with Non-Traditional Mobility Providers

Increasingly, transit operators are collaborating with shared-use mobility providers (carsharing, bikesharing, and ride-hailing TNCs) to provide first/

last mile service, complement fixed-route rail or bus transit service, and improve accessibility services for persons with disabilities and older adults in the community. Expanding the payment scope to involve non-public, often private-sector mobility providers—bikeshare, TNCs, and microtransit—will involve negotiating additional governance agreements and business rules beyond those that are in place among the participating transit agencies. Even among conventional transit providers, these negotiations have sometimes been lengthy and arduous.

MPI Forum and Roundtable participants agreed that transit agencies face better odds of successful negotiation with non-transit mobility providers if the agencies understand the differences between their goals and needs and those of the prospective partners. Those differences arise largely from the profit-oriented status of most non-traditional providers and the competitive business environment in which they operate.

In addition, many, if not most, of these non-transit providers have already created their own access and payment technologies, which will likely complicate technical integration with transit trip-planning and payment systems. Successful multimodal integration will also be dependent upon effective customer education on how the newly-integrated system works and what they may need to do very differently to take advantage of it. Who will provide the education has to be worked out.

Bikeshare, TNCs, and microtransit are discussed below from this perspective. Although the issues raised here may relate primarily to policy rather than strictly payments, addressing them is key if the public transit agency, or agencies, have the intent of partnering to improve customer mobility.

Bikeshare

Bikeshare in the U.S. has been growing rapidly as a mode since 2010. In 2016 alone, riders took more than 28 million trips (Figure 4-1), on par with the annual ridership of the entire Amtrak system and higher than the number of people visiting Walt Disney World each year.[12]
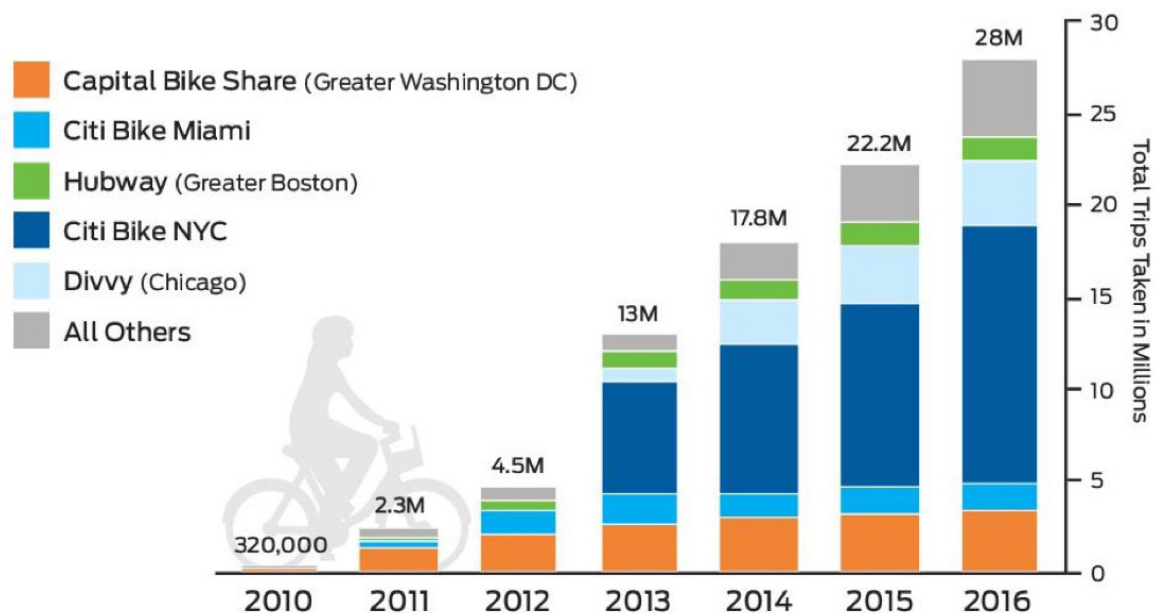
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[12] https://nacto.org/bike-share-statistics-2016/, accessed 5/9/2018.

Figure 4-1

U.S. Bikeshare Ridership by System, 2010–2016
Source: https://nacto.org/bike-share-statistics-2016/, accessed 5/9/2018

Several public transit systems have already implemented some limited form of MPI with bikeshare, and others are or are planning to do so. As a low-cost, sustainable travel mode, bikeshare is arguably a logical place for transit agencies to begin their journeys toward payment integration across all modes.

Many technical, policy, and institutional issues have to be resolved to enable MPI in each location. Understanding these issues and their underlying factors will help support widespread transit/bikeshare in the MPI space.

Bikeshare has been a part of the transportation ecosystem in Europe and Asia for quite some time, but, until the past year or so, has been almost entirely station-based (docking) bikeshare, considered the conventional form in the U.S. Only since mid-2017 has private-sector dockless bikeshare, popular in China, become a significant bikeshare market in the U.S.

Station-Based (Docked) Bikeshare

Station-based (also referred to as docked) bikeshare companies follow any of three business models: jurisdiction-owned and managed, non-profit owned and managed, and for-profit businesses. From 2010 to 2016, most U.S. bikeshare equipment and services were provided by three major companies—Motivate (jurisdiction-owned and managed), B-Cycle (non-profit), and SoBi (Social Bicycles, renamed Jump after Uber bought the company, offering dockless bikeshare). A few cities were using equipment and services from smaller companies such as

NextBike. New York City's Citi Bike, Chicago's Divvy, Washington's Capital Bikeshare, and Boston's recently rebranded Blue Bikes—all operated by Motivate—made up 74% of all American bikeshare trips in 2017.[13]

Station-based bikeshare companies as a population follow three general business models. In all three cases, the system basically involves a rider first registering with the company and (usually) opening an account. The rider then can use the bikeshare company's mobile app to identify an available bike in a location at the starting point of the journey, reserve the bike using the app, unlock it with a contactless fob or other device that has been activated by the system to give access, ride it to the destination, and return it to the nearest docking station. As soon as the bike is recognized by the receiving dock, the bikeshare payment system charges the rider's account based on the amount of time the bike is used.

Bikeshare differs fundamentally from bike rental in that the expectation is of short-term use; if the rider wishes to travel again, the identification/reservation/ride/return model is repeated with another interchangeable bike. All conventional bikeshare business models require the rider to register in advance and either to open an account with the bikeshare company or pay on a per-ride basis by bank card. Some companies offer subscriptions, in which an up-front fee then enables riders to take multiple rides at a time and date of their choosing. Some companies also offer bikes on a per-ride basis; the mixture of rental structures varies.

Jurisdiction-Owned and Managed[14]

In this model, the jurisdiction pays the up-front capital costs and owns the infrastructure and equipment (i.e., bicycles and bike stations). The jurisdiction works with a private contractor that handles membership management, customer service, marketing, bicycle redistribution, data management, and maintenance of stations and bicycles. The government accepts financial responsibility for the program, and the private contractor accepts liability exposure. In the case of Motivate, the largest contractor, the data from bikeshare payment activity are open and available.

Systems subscribed to this model tend to include a mix of federal, State and local grants as well as private contributions in the form of sponsorships. Jurisdictions using this model have used Congestion Mitigation and Air Quality Improvement (CMAQ) and other federal transportation program funding. Additional funding comes from revenues generated from membership and usage fees. For example, under Capital Bikeshare, the multi-jurisdictional system that operates in

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[13]https://nacto.org/bike-share-statistics-2017/, accessed 5/13/2018.

[14]FHWA, "Bike Sharing in the United States: State of the Practice and Guide to Implementation," September 2012, pp. 19–20.

Washington, DC and Arlington County, Virginia, both governments serve as co-owners of the equipment, sharing the costs and any revenues generated by the system and contracting all day-to-day activities to a third-party operator. Another example is Boston's Blue-Bike (formerly Hubway), which requires its operator to share a percentage of any profits and being able to sell advertising on each bicycle and sponsorship for each station. An affiliation between Motivate and Blue Cross Blue Shield expanded the Hubway network and motivated the change of name.

Non-Profit Owned and Managed[15]

In this model, a non-profit organization manages operations and service. The non-profit may have been explicitly created for the operation of the bikeshare program, or it may have already been in existence and added bikesharing service to its existing programs. Local jurisdictions have participated in two ways in this model: 1) the non-profit organization receives start-up funding and some funding for operations from local and state governments and/or 2) the local jurisdiction acts as a fiscal agent to request federal funding and passes funds to the non-profit. This model removes most of the financial liability from the jurisdiction and places it on the non-profit organization, which is responsible for both fundraising and managing operational revenues and expenditures.

Systems using this model tend to use a broad mix of funding sources. Examples include private funding from foundations, local/national energy conservation and/or health grants, and local business sponsorships. Through this model, the non-profit organization may be tasked with providing a financial match to receive certain grants. Because the organization is not-for-profit, revenues generated by membership and usage fees, as well as sponsorships, are typically reinvested into the program. Examples include Boulder B-cycle (CO), Denver B-cycle, Nice Ride MN (Minneapolis/St. Paul), San Antonio B-cycle (TX), and Spartanburg B-cycle (SC), which have favored this implementation mechanism.[16]

Integrating conventional bikeshare into the public transit payment system is a stepwise process. As with the addition of any new services, governance agreements, technical business rules, and updates are necessary.

Because more than 70% of bikeshare rides have been with jurisdiction-owned and managed services usually provided under contract with Motivate, bikeshare is part of the transit agency; however, until recently, the transit and bikeshare elements have had independent payment systems. For integration to succeed, having bikeshare customers get used to using the transit agency's fare medium (smart card) and mobile app instead of the one provided by the bikeshare company takes well-planned customer education and support. Furthermore, the

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[15]*Ibid.*, pp. 20–21.

[16]*Ibid.*, p. 20.

bikeshare company already has its own electronics, customer interface, APIs, and back-end payment management; bringing that into alignment with the transit agency's operations takes intensive work by the agency working with a system integrator.

For-Profit Business[17]

In this model, a private company provides, owns, and operates the service, and government involvement may be limited to certain aspects of planning for stations, such as issuing necessary public space permits. To cover permitting costs for the use of public space, the private bikeshare company may be required to provide a percentage of profits to the jurisdiction (10–25% of profits in one example studied). To generate additional profits, the bikeshare company may sell advertising space on its bicycles and stations. Several successful European bikeshare models, including those in Paris and Barcelona, use this approach.

All capital expenses and operating costs are managed by the for-profit company, relying on a mix of revenues including private investment, sales of advertising on bicycles and stations, and membership and usage fees. Miami Beach's Deco Bike is the first U.S. example of this model, with a local business running the service in a locality that receives a percentage of all profits in exchange for public space usage and permitting.

In Forum discussions, participants described their agency's integration efforts with station-based bikeshare:

- LA Metro is in the process of integrating its Metro Bikeshare into the account-based LA Metro TAP system in three stages. The pilot effort began in 2016 in downtown Los Angeles. In the first stage, the customers learned to link their TAP transit smart card to their bikeshare account and use TAP rather than the bikeshare key fob to access and return the bike. At the Metro Bike Share website, customers can register their transit fare card to ride Metro bikes using the same card to also ride Metro buses and trains. In the second stage, software development will make it possible to use any TAP card on the system; this will require that the card is in good standing, and a hot list (credit cards reported stolen, canceled, or compromised in some way)[18] will be created. In the third and final stage, LA Metro is working with Cubic on integrating the bikeshare and TAP payment accounts, and the pilot has been expanded to Venice and the Port of Los Angeles.
- In Chicago, CTA is working with Divvy, the bikeshare system operated by Motivate, which will offer customers a trip planning feature that will indicate bike availability; the unlock code and payment will work through the Ventra transit stored value cards or the Ventra account.

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[17]*Ibid.*, pp. 21–22.

[18]https://www.bicycletransit.com/our-current-programs/los-angeles/, p. 2, accessed 5/15/2018.

- In Salt Lake City, the UTA is in the planning stage of bikeshare integration. One option for a payment medium would be mobile tokens on a phone app; this would need to be explored technically.

Because most station-based bikeshare providers have followed the jurisdiction-owned and managed model, working through the business rules to guide integration has been technically challenging and has involved prolonged agency-provider negotiations with respect to roles, responsibilities, data sharing, revenue settlement, etc.

Two aspects of bikeshare business models and practices present a more complex set of challenges and lessons learned. The first relates to the goal of substituting the transit payment medium—an account-backed card or mobile app—for the bikeshare's preferred medium. In the case of non-profit bikeshares, that medium may be a credit card. In this model, the non-profit takes on all the financial risk and liability in the relationship. Requiring the customer to use a credit card gives the company some demonstrable means of cost recovery in case of damage to or theft of a bike that has a replacement price tag of perhaps $1,000. The account behind the transit card does not offer that same assurance to an insurance company.

The second relates to compatibility of fare structures. One MOD Sandbox project intended to tie in bikeshare through a soft link to a third-party app and defined the transit fare structure for single-day passes only, anticipating that the local bikeshare had a similar arrangement with its customers. In fact, the bikeshare offered only monthly memberships. At the time of the Roundtable teleconference, this disconnect appeared to be unresolvable.

The emergence of dockless bikeshare in some cities with MPI underway—Los Angeles, Chicago, and Portland (OR) among them—raises new policy and technical challenges. These companies are privately-held and have a novel business model compared to for-profit station-based bikeshare. Learning about how they operate will be important for deciding whether to integrate them into the new payment system and how to do it. In Portland, BIKETOWN conventional bikeshare is available, but TriMet, while integrated with other transit providers, is not yet tied in to it, and there is no public indication by either entity that this is under consideration. Research into the city, the agency, and the company thinking would produce insights of value to other locations in a similar situation.

Dockless Bikeshare

As of the end of 2017, five new major dockless companies (Jump [formerly SoBi], Limebike, MoBike, Ofo, and Spin) and a number of smaller companies (e.g., Pace [formerly Zagster], Donkey Republic, VBike, LennyBike, and RiiDE) had opened

systems in the U.S. A sixth company, BlueGoGo, which was the first to roll out dockless bikeshare bikes in the U.S., declared bankruptcy in summer 2017.[19]

In dockless bikeshare, a rider locates and accesses a bike via a mobile phone app. Unlike station-based bikeshare, the bikes do not require a dock to be parked; rather, they can be left anywhere and are secured via a wheel-locking mechanism that the app unlocks. This arguably increases the convenience of access and drop-off for customers.

Station-based for-profit bikeshare companies limit their networks because of their immediate profit objectives. In marked contrast, private dockless bikeshare companies, to date, are largely relying on venture capital to finance their operations (by Summer 2017, several bikeshare companies across the world had amassed a total of more than $1 billion in funding). Dockless bikeshare companies, therefore, do not have to rely on subscriptions or revenue to operate, and they charge less for a ride than do conventional bikeshare companies. However, many bikeshare experts say they are skeptical that private dockless bike companies can survive on $1 for a ride for which cities charge $2 or $3, meaning they would need many more rides per bike to be profitable.[20]

However, projecting the viability of these dockless companies depends on underlying assumptions. If the assumptions are compared with those of conventional bikeshare operations, the pessimism may be overstated, because dockless bikeshare costs are different from docked bikeshare:

- Dockless bikeshare has a smaller payroll, for example, because it does not need personnel to continuously assure that stations have the bikes that have been reserved and the open docks to receive returns.
- The capital outlays to run a dockless company are lower. Ofo, Mobike, Limebike, Spin, and Jump are entirely private operators that own their equipment, which is self-locking and free-floating (although Jump presumably requires users to lock to public bike racks or sign poles in the same fashion as SoBi's non-electric bikes).
- Dockless bikes are cheaper compared to docked equipment and, by definition, do not require docks. In 2016, new station-based bikes offered by PBSC Urban Solutions, pre-Jump SoBi, and B-Cycle cost more than $2,000 per unit.[21] (Prices have come down considerably since then; the manager of a not-for-profit bikeshare gave a $1,000 estimate in the MPI bikeshare Roundtable in April 2018.) The hardwired, kiosked "smart" docks at which most bikes are required to park are even more expensive. Overall, dockless bikeshare is a substantially less expensive business model to sustain.

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[19] https://nacto.org/bike-share-statistics-2017/, accessed 5/13/2018.

[20] R. Beitsch, "Why Dockless Bikes May Spell the End of the Old Bike-Share Model," Stateline, 10/18/2017, http://www.pewtrusts.org/en/research-and-analysis/blogs/stateline/2017/10/18/why-dockless-bikes-may-spell-the-end-of-the-old-bike-share-model, accessed 5/15/2018.
[21] https://www.citylab.com/transportation/2018/04/a-complete-taxonomy-of-bikeshare-so-far/558560/

If a city is interested in simply permitting dockless bikeshare to operate, doing so does not incur much financial risk. However, if the city wants to integrate dockless bikeshare payment at some cost to the city, then this integration may involve a substantial financial outlay. Given the uncertain financial future of dockless bike companies, a city must weigh the financial risk against potential longer-term equity benefits to the city, such as access to jobs by populations that otherwise would have difficulty getting to them inexpensively. This could promote some measure of economic growth; it becomes a policy issue rooted in equity considerations.

The reason for that interest is often that station-based bikeshare tends to operate in areas of high economic activity and in neighborhoods whose residents can make the up-front outlay of a subscription to ride. Less economically-vibrant areas of a city, which can also be heavily communities of color, do not have the same access to or benefit from the bikeshare system. They also may have a relatively high proportion of non-banked or underbanked residents.

A number of cities have been subsidizing bikeshare in those underserved neighborhoods and populations. Among cities with station-based bikeshare systems, 32% have an income-based discount program, using income thresholds or living in affordable housing as criteria. This is a 33% increase over 2016, when about a quarter of all cities had income-based discount programs.

Newer systems, such as Detroit's MoGo, have followed this model. MoGo launched with a widely-publicized $5 annual AccessPass, available to Detroiters who receive State food assistance. After six months, AccessPass sales have made up 18% of all long-term pass sales. MoGo also offers a cash-payment membership option that is well used by AccessPass holders. Together, AccessPass and the cash-option provide fast, flexible, and convenient access to transportation for hundreds of residents.[22]

Dockless bikesharing has increased the number of bikes dramatically, nearly doubling the number of shared bikes by adding 44,000 dock-free bikes in the U.S. Only Washington, DC has allowed dockless bikes to operate where docked systems already exist.

Venture capitalists see the potential for economic return by sending dockless bike fleets into areas not served by conventional bikeshare, and some cities are seeking to get dockless companies to fill the gaps and expand service beyond city-owned bikeshare systems.[23] This could reduce the need for direct subsidization of bikeshare by the city. In 2017, 12 dockless bikeshare companies were asking the New York City Department of Transportation to pilot dockless

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[22]NACTO, "Bike Share in the U.S," 2017, p. 6, https://nacto.org/bike-share-statistics-2017/, accessed 5/13/2017.

[23]R. Beitsch, https://www.pewtrusts.org/en/research-and-analysis/blogs/stateline/2017/10/18/why-dockless-bikes-may-spell-the-end-of-the-old-bike-share-model, accessed 5/15/2018.

bikeshare in outer-borough neighborhoods that Citi Bike has not yet reached, including in the Bronx and on Staten Island. Chicago's pilot program permitting dockless bikeshare for operation in the city's South Side, along with companies like Ofo and Jump donating to a bike library aimed at helping low-income users try dockless bikes, represents the first city dockless permit explicitly aimed at expanding coverage to underserved neighborhoods.[24]

During 2017 and 2018, the Los Angeles City Council approved the concept of a pilot program for dockless bikeshare; at the time this scan was completed, efforts were underway to develop rules and guidelines for dockless bicycles, electric-assist bicycles, and electric scooters so the pilot program could be approved.[25] Because these are private providers, integrating their systems into TAP will involve a significant effort on all sides, and it was not clear at the time of the discussion what the incentives might be for the private operator to undertake integration and the opening of currently proprietary APIs. However, the permitting process itself and the prospect of increasing ridership and, therefore, revenue are likely to be factors.

In all cases, coming to a satisfactory agreement with dockless bikeshare companies on data sharing will be pivotal in a decision to integrate, as will be the inextricable need for agreement on how to preserve privacy when payment data are shared.

Transportation Network Companies (TNCs)

Of the three non-transit mobility provider types, it appears from MPI participant experience to date that the integration of TNCs into urban and regional mobility systems will likely be the largest challenge to the fulfillment of the MPI model.

The emergence of TNCs—first Uber in 2009 and, later, Lyft—has had a major effect on personal mobility in the U.S. The transformative power of Uber came through the empowerment of the user and the ability to create a large supply of drivers with their own private vehicles. The model empowers the user as travelers can hail a ride, track the location of the identified ride-hailing provider on its way, select among different ride options (e.g., shared, luxury limo), pay via the app, and tip and rate the driver after completing the trip.

On the driver side, Uber has created a vast pool of supply by allowing drivers to determine when and for how long they work, building up a force of part-time drivers. Through its flexibility and acceptance, Uber has, in effect, increased the taxi market.[26]

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[24]*Ibid.*
[25]City of Los Angeles, Official Action of the Los Angeles Council, Council File No. 17-1125, May 18, 2018, http://clkrep.lacity.org/onlinedocs/2017/17-1125_rpt_DOT_05-18-2018.pdf.
[26]J. M. Rivera, "Business Model Revolution Ahead for System Integrators," 1/12/2017, *Automation World,* https://www.automationworld.com/business-model-revolution-ahead-system-integrators, accessed 520/2018.

A city, MPO, or transit agency may see TNCs as a potential solution for a number of mobility management problems—as a provider of same-day, on-demand paratransit to older adults or persons with disabilities, as the means to help address the first/last mile gap at the fringes of the fixed-route transit system, or to be available as a more direct route to the end of a customer's journey than other available options, including public transit.

Uber and Lyft are collaborating with public transit agencies and regional planning organizations in mobility management services. A number of cities and transit systems across the nation have made arrangements or plan to partner with TNCs to improve access to public transit and mobility.[27] Some of these arrangements create first/last mile solutions, others provide paratransit services, and some do both. Examples include the following:

- **Pinellas Suncoast Transit Authority (PSTA) (FL) and Uber** – PSTA partnered with Uber to subsidize first/last mile trips that serve designated transit bus stops. Trips had to begin or end at the designated stop and PSTA paid half the fare, up to $3 per ride. In 2016, PSTA also operated a State-sponsored demonstration program providing Uber service for low-income residents in a small pilot area; because of the success of the one-year pilot, the service was extended to cover all Pinellas County for the ensuing six months.[28] Also in 2016, PSTA was awarded an FTA Mobility-on-Demand Sandbox grant to provide on-demand services to paratransit riders by Lyft and several non-TNC providers.[29]
- **Centennial (CO) and Lyft** – In August 2016, the City of Centennial announced a partnership with Lyft that, within the eligible service area, would fully subsidize all Lyft Line rides to and from the Dry Creek Light Rail Station during commuting hours.
- **Dayton (OH) and Lyft** – The Dayton Regional Transit Authority (RTA) is partnering with Lyft on an app that connects Lyft customers from several small towns near the city to designated transit stops. The program, termed "RTA Connect," is the first of its kind in the state, in which riders to certain stops can get free Lyft rides to other stops. RTA has designated a number of RTA Connect Transfer Points at several stops, including Farmersville, Germantown, and Miamisburg, in an effort to increase service to those stops during the mid-day, nights and weekends.[30]
- **Research Triangle (NC) and Uber** – Go Triangle provides long-distance rides between Raleigh, Durham, and Chapel Hill, each of which has its own local bus service. Go Triangle has a three-way business arrangement with

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[27]NYPTA White Paper, "Appendix C, Experience of Other Transit Systems," pp. 14–15.
[28]https://www.psta.net/about-psta/press-releases/2016/psta-expands-transit-partnership-with-uber-lyft-across-pinellas-county/.
[29]https://www.psta.net/about-psta/press-releases/2016/psta-announces-innovative-program-to-serve-passengers-with-disabilities-including-veterans/.
[30]https://www.bizjournals.com/dayton/news/2017/06/01/rta-partnering-with-lyft-to-increase-service.html.

Uber and TransLoc, a firm that provides real-time bus schedules, to promote a smart phone app that allows passengers to plan their route and book an Uber to cover the trip to or from the bus stop. The TransLoc Rider app allows people to find the best travel route, whether through public transit, walking, Uber, or a combination, and provides real-time bus information.

- **Philadelphia (PA) and Uber** – The Southeastern Pennsylvania Transit Authority (SEPTA) had a cross-promotion with Uber to encourage transit riders to use the service to get to 11 specific train stations along its commuter rail system. Uber offered riders a 40% discount to or from a train station. The program was targeted at stations where park-and-ride lots filled early or stations were under construction with limited parking.

- **Dallas (TX) and Uber** – Dallas Area Rapid Transit (DART) and Uber announced their partnership integrating DART's mobile ticketing system with Uber. Riders can access Uber directly from DART's mobile app to quickly plan their trip using both services, helping riders who cannot easily access their transit stops.

- **KCATA (MO) Ride Hailing Service (Taxis)** – The Kansas City Area Transportation Authority (KCATA), in partnership with Transdev, is rolling out an app-based public transit service called RideKC Freedom On-Demand. This one-year pilot enables customers to call on taxis at any time. The new app-based option begins with a strong core transit service for persons with disabilities and will also provide fast, affordable cab rides for everyone. There is a call-in option for those who do not use smart phones. Scheduling does not require 24-hour notice, as does the current paratransit system. Customers can pay with credit or debit cards via the app or in the vehicle and with cash in the vehicle. ADA customers pay $3 for the first 8 miles in the service areas and $2 for every mile thereafter. Non-ADA customers age 65 and older pay $5 for the first 8 miles in the service areas and $2 for every mile thereafter. All public customers pay $10 for the first 5 miles and $2 for every mile thereafter, which is similar to other local ride-hailing services.

- **MBTA Partnership Pilot Program with Uber and Lyft** – In September 2016, the Massachusetts Bay Transportation Authority (MBTA) announced the planned December launch of a paratransit partnership pilot program with Uber and Lyft for riders with disabilities and older adults. Registered users can request a ride through Uber, Lyft, or multiple Boston-area taxi providers; wheelchair-accessible vehicles are also available upon request. At the time of launch, the existing paratransit service, The RIDE, was operating at a variable cost of $31 to the MBTA; customers faced a $3.15 set fare. Although The RIDE requires a minimum of one-day advance notice, pilot participants have on-demand service available via their smart phone app or through the phone-in option. Participants pay the first $2 of the trip, the MBTA covers the next $1, and the customer is responsible for any remaining trip costs. The pilot was originally scheduled to run for 12 months, finishing at the end

of December 2017, but it was so successful that it was extended until April 2018. According to the MBTA, taking on-demand trips with Uber and Lyft has been so popular among some of its customers with disabilities that one in five of those participating in a pilot program have stopped using The RIDE. MBTA staff have recommended that the program continue, at minimum, through June 2019. Discussion of the future of the service will occur during the MBTA's FY 2019 budgeting process.

Joint service provision by transit and TNCs is clearly feasible. Obtaining TNC participation in MPI has proven to be challenging, however. Data sharing is a major hurdle; TNCs have been deeply resistant to public transit agency stipulations that they provide ridership data. The agencies take the position that they need the data to optimize their system availability to travelers. However, from the TNC perspective, they are engaged in a fiercely-competitive contest for customers and market share with one another and refuse to risk a leak of data to one another that could divulge favored routes, fare structures, or other information invaluable for competitive strategy. Further, they are privately-held businesses with very few regulatory constraints, and they do not wish to share anything with the public sector that, if scrutinized, would run the risk of intervention and possible regulation.

As an example, at least two MPI participant agencies that approached the TNCs with an invitation to become an element in trip planning were told that a design in which the travel planning app was agnostic to the TNC and offered the customer a route that included whichever TNC was closest would be unacceptable. Each wanted the app to offer only its services so it could preserve its relationship with existing customers and capture new ones.

When attempting to create an integrated payment solution that merges transit and TNC services, it is essential that the agency, city, or regional planning organization determine the value to a TNC derived from participation in mobility payment integration. TNCs already have their own proprietary ride-hailing/payment apps and a communications network to the drivers in their voluntary fleets. Their brand recognition is already enormous, so co-marketing would be of questionable value relative to the perceived risks and encumbrances of integration. Uber is already aggressively modifying its business model to become a multimodal provider, having recently acquired Jump, a leading dockless bikeshare provider that will now be co-branded with Uber.

Nonetheless, transit agencies, and perhaps the FTA MPI Program and FTA, need to give careful thought to how to create added value for TNCs if they are to be lured into participation in MPI. For example, could there be some marginal financial premium each time the TNC books a public transit trip?

Microtransit

Urban and rural areas are experimenting with microtransit as a potential solution for at least four problems:

- Addressing first/last mile needs of outlying areas to reach conventional fixed transit stations and hubs.
- Providing on-demand transit service in transit-poor pockets within metropolitan areas.
- Replacing fixed bus routes that no longer have sufficient demand to objectively justify their continued operation with smaller, on-demand vehicles.
- Providing group, rather than individual, transport to special needs travelers, such as seniors.

Microtransit is sometimes grouped with TNCs, which misses the distinct difference in their business models and, thus, may overestimate the difficulties of bringing microtransit into the MPI fold. Incorporating microtransit is of interest to several public transit agencies. To date, the MPI Program team has engaged with two providers—Via and Ford Chariot.[31] These two microtransit companies also differ in their service model design and the market niches they are seeking to fill.

Via, a microtransit provider, operates its own shared-ride service in the New York, Chicago, and Washington, DC markets, and licenses its technology to partners. In the MPI Roundtable discussion, the Via representative said that the idea of MPI is important to the company because Via's business model is to augment or substitute for existing public transit. It would like to see integration advance in the areas of app development for mobile trip planning/booking/payment. Via believes its service will be more successful in meeting regional transit needs if customers can connect to fixed-route transit. This has been proven in principle; they would like to be able to expand regionally. In Phase 1, a customer's transit card was an optional form of payment; in Phase 2, Via would like to more deeply integrate with the transit payment system.

Auto manufacturers are looking beyond their original business model of producing individual automobiles to entering new mobility markets in anticipation of the continued reduction in use of personally owned automobiles in urban areas. In 2016, Ford acquired Chariot, a microtransit start-up with a fleet of Ford vans in San Francisco,[32] and launched it as a microtransit service option. Chariot offers both private and public microtransit service. This "enterprise" jitney service on contract to private entities is the larger proportion of business in four cities—the Bay Area, Seattle, New York, and Austin (TX). The business model

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[31] In January 2019, Chariot announced that it would cease all operations by Spring 2019.
[32] M. DeBord, "Ford is Buying Y Combinator Shuttle-Van Startup Chariot in an All-Cash Deal," *Business Insider*, 9/16/2016,

is still evolving; currently, Ford Chariot allows commuters to find a shuttle ride with a smartphone app. The public microtransit business model takes somewhat different forms in the four cities, and it is still evolving. In New York City, service is offered in areas not served by public transit, providing faster, more direct connections to transit hubs (for example, from Astoria directly to the East Side). In San Francisco, the MUNI bus system has insisted that the City limit Chariot's operations to routes not already covered by MUNI, even when service has large time gaps between runs.[33]

The FTA MPI project team's discussion with the company indicated that payment integration is a topic of interest but still somewhat embryonic; Chariot is particularly interested in integration with bikeshare. Chariot plans to attract more riders by becoming more of a dynamic service. The next evolution of the company's service will be to schedule customers based on more sophisticated on-demand models and algorithms. Ford says that these dynamic shuttles, which will operate on demand based on user needs rather than fixed routes, have the potential to reduce congestion.

Multimodal Pricing Policies, Fare Rules, and Transfer Agreements

Many transit authorities are attempting to simplify fare policies and rules before implementing new payment systems. Transit agencies and mobility service providers need to determine how trips involving more than one mode will be priced. Policies and programs related to payments should be aligned with regional transportation goals. Transit programs must comply with equity requirements of the federal Title VI statute to provide access to services for all.

Fare Simplification

Several transit agency representatives commented on how their fare structures had expanded and become unnecessarily complicated over their history, with some fares still in place that were not needed on a stand-alone basis. Coming up with a simplified formula was reported to be an intensive proposition, requiring rounds of public outreach and feedback.

When it reviewed its policies, the San Diego Metropolitan Transit System realized that it had a very product-based fare standard. As the result of a two-year study, it is about to move several fare structures into daily and monthly passes and is merging special passes into a single pass. The agency plans another fare study to further refine its fare structure and believes that it is important to make fare payment easier for both customers and the agency to manage; fare issues can be inhibiting for customers who have not used transit previously.[34] A participant from another transit agency that is in the process of implementing MPI concurred

[33] https://www.chariot.com/.
[34] I. Moldonado, San Diego CTA, MPI Forum #4, 3/26/2018.

with this point, adding that simplifying the fare structure also reduces the cost to the agency of preparing informational print media for in-vehicle posting, because fewer variations and, therefore, fewer separate production runs are necessary.

TriMet's previous fare structure included zone pricing and features that public input recommended dropping. Getting to an acceptable new structure took multiple rounds of proposals and feedback and several years.[35,36] Because the final structure involved fare capping, rolling out the new system required a significant effort to explain the new approach to the public, as well as redesign of the agency website. TriMet offered a major recommendation to other agencies considering fare capping: "Don't call it fare capping. No one will understand it. It needs to be called 'earning your pass' or something else along those lines." TriMet's website explaining the new fare system represents a good model for fare simplification.[37] TriMet's regional partners in MPI are C-TRAN and Portland Streetcar, both of which are smaller than TriMet and largely followed TriMet's model on fare simplification; C-TRAN saw this as an opportunity to better align fare policies and structures. The smaller agency had to negotiate to a single fare for the express commuter bus fare from Vancouver (WA) to Portland (OR).[38]

Given the level of effort needed to bring about fare simplification, an agency might ask whether it is worth it. The lead transit agency in a system involving a dozen transit partners had not effected fare simplification before integrating payments: "We're one smart card, but with 26 different fare structures. It required a ton of custom configurations and related testing." In other words, the system can be built to accommodate multiple fare structures and the myriad business rules that are needed to enable settlement.

San Francisco's Clipper System chose to allow all the member agencies to retain their own fare structures. Cubic, the industry's largest fare payment systems integrator, reported the following data for their processing of Clipper System payments in an individual Roundtable meeting in March 2018:

- Accepted on 23 transit agencies, more than 95% of transit operators in the San Francisco Bay Area
- Processed 1.2+ billion transactions and settled more than $2.5 billion in revenue
- Processes nearly $50 million per month in transit agency revenue
- Field services support more than 10,000 devices
- Approximately 6 million cards issued
- Nearly 35,000 business rules
- Support 260+ products, including different purses, monthly passes, travel tokens, etc.

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[35] http://www.rosecitytransit.org/mystuff/other/faresystem/, accessed 5/17/2018.
[36] http://blog.oregonlive.com/commuting/2012/01/trimet_considering_major_fare.html, accessed 5/17/2018.
[37] https://trimet.org/fares/index.htm.
[38] K. Nelson, "Fare Collection: Implementing Mobile Payment," Mass Transit Webinars, 2/15/2018.

Those last two points give a sense of the size of the integration job. An integrated fare payment system can be built to accommodate multiple fare structures and the myriad business rules that are needed to enable settlement. Intuitively, however, the more complex the system—even if procured on a performance requirement basis—the more expensive it may be, and the overall cost per transaction or per settlement may cost more as well.

Fare Rules

MPI Roundtable and Forum participants commented on their experience with two topics related to fare rules—fare capping and cash vs. cashless.

Fare Capping

Fare capping, although in use in major European systems, including Transport for London (TfL), has been slow to catch on in the U.S., perhaps because its implication requires an account-based, open-loop payment architecture, which is only emerging now. As noted, fare capping has been instituted in the regional system lead by TriMet. San Diego's current procurement for MPI specifies fare capping, and the new MBTA AFC 2.0 system under development by Cubic will not launch with fare capping but is designed to be able to accommodate that plus other potential (future) changes to the fare structure.

The TriMet system is presented to customers as Save as You Ride.[39] Branded as Hop, instead of buying passes in advance, riders earn them as they go, saving on a pass without the upfront cost. They never pay more than the cost of a day pass in a day or a month pass in a month and pay only for the trips they actually take. Riders who pay per trip do not incur further charges once they reach a certain threshold. For example, a single TriMet bus trip costs $2.50, and a daily pass costs $5. Fare capping means that a person who rides the bus three times in a day will not pay for the third trip, even if each ride was purchased separately.[40]

Even with skilled simplification in the communications around fare capping, getting the public to a level of comfort sufficient to retain ridership and ensure smooth operations is effortful and requires intensive public education[41] "The idea is complex to explain and build needed trust in the system."[42]

Although the design features of MPI are an advance in reducing customer fraud, fare capping may still be gamed—for example, two people who share a smart phone account can hand off the phone to the other and reach the fare capping limit faster than either could individually. New technical advances will enable the creation of "breadcrumbs" that travel along with an account; it will be possible

[39]https://trimet.org/fares/index.htm.
[40]A. Schmitt, "Portland Debuts a Fairer Way to Pay for Transit Fares," Streetsblog.org, 8/16/2017, https://usa.streetsblog.org/2017/08/16/portland-debuts-a-fairer-way-to-pay-for-transit-fares/, accessed 2/19/2018.
[41]K. Nelson, "Fare Collection," 2/15/2018.
[42]C. Kuester, Director, Electronic Payments, San Francisco MTA, comments during MPI Forum #2, 1/29/2018.

to tell that two different people are involved, even if they share the same bank account, and the bank will be able to notify the transit agency that each individual should have a separate transit account.[43]

Cash vs. Cashless

Even in regions with AFC, buses may still accept cash. When making the upgrade to an open-loop and/or account-based system, whether to continue to allow cash as a fare medium becomes a business decision. Outside of transit agencies, the other sectors have firm views on the desirability of going cashless. The payment/financial sector is very much in favor of reducing the use of cash in favor of contactless bank cards, as are banks and developers of mobile planning/payment solutions. Integrators are prepared to build a system to the customer's specifications, but advances in MPI toward contactless payment will depend upon eliminating cash from the direct process of paying a fare.

Transit agencies are moving to reduce cash payment. In relation to buses, the advantage of cashless payment is that cash payment transactions slow up boarding; all passengers have to board through the front door, and a long line can push a bus and a route behind schedule. Cashless payment speeds up boarding through the front door and enables boarding through other doors.

San Diego, which is in the process of procuring a new fare payment system, reported that on buses, cash issuances are down to 12–14% of payments. Purchase of passes using ticket vending machines (TVMs) shows a 60/40 ratio card vs. cash; the new system is asking for a highly-configurable and modular machine to limit cash. The agency has decided that it would be too aggressive to move to cashless on buses at this time; after the new system goes live, the agency will assess how customers are taking to the card retail network and mobile options, and, after analysis, may decide which way to proceed.[44]

In Dallas, DART will still offer fare products in physical media (cash, farebox). The agency has gone to the simplest new fare box available in anticipation of reduced volume of use. Currently, single bus rides may be paid for with cash only; DART expects tap-on and mobile to supersede cash in about two years.[45]

The MBTA, in contrast, is taking the leap directly to a cashless system because it believes the improvement in bus on-time records will benefit customers. In addition, building the system this way will enable future integration. The MBTA assumes that everyone will be digital in the future. The agency has been aware of public concerns about how this will work and where they will be able to get a cash-paid fare card. Quality standards specified in the system reflect the question of what venues are available at which customers can use cash to purchase fare

[43]J. Dogin, Vice President, MasterCard, comments during MPI Forum #5, 4/23/2018.
[44]I. Moldonado, San Diego MTS, comments during MPI Forum #3, 2/26/2018.
[45]D. Leininger, comment during Mass Transit Webinar: Fare Collection: Implementing Mobile Payment, 2/15/2018.

cards and how many machines to put in each location. The standards set for the system integrator are that 95% of customers must be able to use cash within 1,000 feet of an MBTA stop and 98% within 2,000 feet.

The decision to go completely cashless makes certain assumptions about the robustness of the system to support it. However, there is at least one worst-case scenario that suggests that consideration of further fallbacks might be prudent. In 2016, ACI Universal Payments conducted a survey to assess the current sentiment of U.S. public transportation riders in regard to payment preferences and payments security. The survey encompassed 2,006 riders from the 9 largest metropolitan transportation systems in the U.S.[46] With regard to payment security:

> More than three quarters (78%) of mass transit riders currently trust that the payments process for mass transit in their city is secure, and nearly the same (76%) trust their mass transit authority is protecting their payments information. **However, if their payment data was compromised (by data breach or fraud), nine out of ten people would likely revert to using cash for mass transit payments.** When asked to rank their current perception of the security of individual payment types, not surprisingly riders viewed cash as the most secure method of payment. Among non-cash payments, all types of credit/debit card payments are viewed as the most secure, with 29% of riders viewing credit/ debit card payment at a physical location as very secure. Using a mobile app for payment is viewed as secure by 38% of respondents.[47]

The scenario in which a transit agency's account management system is hacked is not entirely far-fetched in today's world. Agencies that have assigned the job of account management to a highly experienced integrator may be better protected in terms of system security than an agency that chooses to retain direct ownership over the account system, but both may want to "stress test" their assumptions regarding the needed number of fare cards available to the public, should up to 90% of their overall ridership be abruptly inclined to prefer them.

Multimodal Subsidies, Discounts, and Incentives

Multimodal payment systems and account-based systems will make it easier to manage traveler demand and can encourage travel patterns that support regional transportation goals. Transit agencies are subsidizing mobility services provided

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[46]No information on how respondents were selected or screened is given in the report.
[47]ACI Universal Payments, 2016 ACI Worldwide Mass Transit Payments Survey, p. 5, https://www. aciworldwide.com/-/media/files/collateral/trends/2016-aci-worldwide-mass-transit-payments-survey-tl-us.pdf, accessed 2/8/2018.

by TNCs, microtransit, and taxis where the services can be provided more cost-effectively than services provided by the transit agency.

Subsidies can be provided to mobility providers who serve selected groups of riders. The source(s) of subsidy payments (i.e., transit agency, human service agency, employer, other) must be determined, and the customer's account may have to include separate purses to comply with tax regulations.

To date, comments in reference to subsidies and incentives have been made in the context of other FTA MPI Framework topics, but are aggregated here as the point of primary relevance. One issue concerned the handling, during the settlement process, of employer benefits that are addressed by the Internal Revenue Code. The example given was a person who purchases a multimodal pass; there were two questions: 1) How does the monthly benefit work in relation to settlement from the purchasing side? (this assumes that the purchase is being made by the individual, not in bulk by the employer), and 2) If the purchase is subsidized, how does the settlement process take that into account?

The scope of vehicles on which the benefits presently may be used is also an issue. According to the 2017 *Internal Revenue Service Fringe Benefits Guide*,[48] a transit pass is any pass, token, farecard, voucher, or similar item entitling a person to ride, free of charge or at a reduced rate, on mass transit or in a vehicle that seats at least six adults (not including the driver) if a person in the business of transporting persons for pay or hire operates it. Mass transit may be publicly or privately operated and includes bus, rail, or ferry. For guidance on the use of smart cards and debit cards to provide qualified transportation fringes, see Revenue Ruling 2014-32, 2014-50 I.R.B. 917, available at IRS.gov/irb/2014-50_IRB/ar06.html.

Although this rule clearly excludes use on conventional passenger vehicles and, thus, in passenger vehicles operated by Uber or Lyft, it may be interpreted to mean that a Smart Benefits pass could be used on a Via microtransit 6- or 15-person van. It would be helpful for the FTA MPI Program to obtain clarification on this point from the IRS.

A mobile transit planning apps developer observed that benefits for parking also need to be settled into a separate purse.

Procurement and Partnership Strategies

Open, non-proprietary specifications, such as performance requirements for "real-time" account-based systems, will enable transit agencies to purchase equipment competitively, accept more types of payment media, and accept new technology as it evolves. Public-private partnerships such as the one created by

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[48] https://www.irs.gov/publications/p15b.

the MBTA can reduce the amount of public capital funding required and risks to the transit agency. Licensing agreements may be needed for mobile apps and other software. Transit agencies must determine if the sources of funding they are using allow them to penalize payment processors if performance specifications are not met.

Some transit agency participants in the MPI Forums expressed concerns about what they perceive to be their agency's vulnerability in their relationship with the integrator and the integrator's team, particularly with respect to risks associated with performance, data ownership, and timely maintenance. The experiences they describe have, to some degree, been the result of the procurement processes and contract terms their agencies have pursued in the past. Other agencies, however, recently have been able to adroitly persuade the entities overseeing them that, by adopting new procurement strategies, such persistent issues can be dealt with satisfactorily. The new procurement strategies fall under the overlapping umbrellas of software-as-a-service and public-private partnerships.

Software-as-a-Service

The software-as-a-service approach to transit agency procurement recognizes the essential difference between conventional procurement practices for hardware and hardscape vs. that for software. The critical difference is the technical complexity of software, coupled with singularly more demanding criteria both for operations and for maintenance. Conventional transit procurement is a one-and-done exercise. The agency issues a Request for Proposals containing extensively-detailed requirements and specifications for the deliverable, including expected lifetime. The vendor manufactures the deliverable, tests it, and delivers it. The agency receives the deliverable, may do its own acceptance testing by its own or hired experts, and then most (at minimum) of the risk of untroubled operation and ongoing maintenance rests with the agency.

Software, in contrast, is a highly-specialized world of successive versions (continuous upgrades and modifications) that are best performed by the originating vendor under a contract arrangement. The intellectual property of the software may still reside with the vendor, but use is licensed to the agency under specified terms. Responsibility for maintenance is assigned by contract to the vendor, with specified timeframes for acceptable performance (e.g., "the system must be returned to operating order per specifications, undergo retesting, and be available for use within three business days"). If the software is integrated into an Internet platform, continuous upgrades to ensure the software's security become a contract feature.

When integrated payment system software is being procured, the vendor may need to be engaged under a longer-term (e.g., 5- to 10-year) contract that defines key performance benchmarks, service agreements, transaction estimates with

lower and upper annual ranges, and clear cost parameters for transactions and support. The contract should reflect a clear understanding of:[49]

- the role of merchant payment providers
- credit card commission and transaction fees
- prepaid gift card platform providers
- cash-to-mobile conversion options; this is important and can become a "no man's land" if not thoroughly considered

Emphasis should be on customer-facing functionality and on seamless and regular updating to accommodate new mobile phone operating service (OS) upgrades and minor agency refinements.

Public-Private Partnerships (P3)

Approaching procurement for mobility payment integration with a software-as-a-service structure is fundamental to success. To improve the procurement significantly further, however, layering on a P3 approach may reduce the amount of agency capital funding required for the project and the risks to the transit agency over the life of the contract.

Using performance-based contracting[50] aligns the incentives of the private sector with the goals of the agency and establishes a balanced, cost-effective risk allocation, transferring appropriate risk to the vendor. Private financing is required as security for performance; the private-sector vendor provides the upfront funding for the capital investment, and the agency achieves ownership of the assets. The contract provides for close coordination among installation, maintenance, operations, and customer service. Integrated project delivery provides for a single point of responsibility, expedited project delivery, and a life-cycle cost approach to project decision making.

In the arena of MPI, the MBTA's finalization of a P3 system integration contract for AFC 2.0 is emblematic of what is possible for transit agencies. The MBTA entered into a single contract with the systems integrator, who is responsible for the design, installation, finance, operations, and maintenance of the system; the contract has a 13-year initial term and two 5-year extension options.[51] The procurement process for this large and complex integration required a substantial commitment of internal agency resources as well as the engagement of outside experts.[52] This, in turn, required significant internal and external coordination, supported by leading partners in industry.

The project also set a new MBTA precedent for proposer engagement. After a round of pre-qualification reduced the number of actual proposers to four,

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[49]D. Leininger, "Fare Collection," 2/15/2018.
[50]MBTA, AFC 2.0 Systems Integrator Contract, presentation before Fiscal Control Management Board, 11/20/2017, Slide 11, https://cdn.mbta.com/sites/default/files/fmcb-meeting-docs/2017/november/2017-11-20-fmcb-afc2.pdf.
[51]*Ibid.*, Slide 12.
[52]*Ibid.*, Slide 17.

The MBTA conducted five rounds of one-on-one meetings with each proposer team, including site visits to MBTA stations, vehicle inspections and facility tours, device demonstrations, an online Q&A forum, and a written comment submission process. Significantly, the contract was negotiated with the proposers *prior to the award.* There were iterative updates to the Project Agreement section that were released to the proposers between November 2016 and June 2017, and changes to the contract were made in response to proposer questions and feedback.

The final selection of the system integrator was based on a best value approach, considering the technical solution and the price. These were evaluated separately:

- For the technical proposal evaluation, the Selection Committee considered information from the proposals, clarifications, subject matter expert reviews, field teams, and proposer interviews. The technical requirements provided proposers not with fixed values, but with performance requirements, which gave the proposers the ability to design innovative solutions to reduce costs, minimize risks and improve outcomes.
- The financial proposal evaluation scoring used net present value (NPV) to assure equivalency across the proposals. Each proposer's price was evaluated on a comparative basis against the lowest price received. The price proposal included committed pricing for the initial term, both option terms, and unit prices for unplanned expansion. The proposers were required to include committed financing as part of their proposals. Debt providers independently assessed the risk of the proposer being able to deliver the project on-time and on-budget.

A key advantage of P3 contracting is risk reduction. A P3 contract structure balances the risks between the agency and the integrator very differently compared to conventional contracting. The risks transferred from the agency to the system integrator are performance, including that of subcontractors; all aspects of contract services, including financing and cost overruns; and handback at the end of the contract term. The risks retained by MBTA are the benchmark interest rate prior to the financial close, supervening events, failure to pay, and construction and installation in stations and other public areas (which, because the Design/Build part of the job under Massachusetts law, must undergo a separate procurement).

The MBTA makes no progress payments to the system integrator for performance of implementation work; payments phase in as milestones are successfully achieved.[53] The system integrator must monitor system performance and provide reports to the MBTA. Monthly payments will be subject to substantial performance-based deductions:

- Up to 50% of the system integrator's monthly payment is at risk for poor performance.

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[53]*Ibid.,* Slides 3–12.

- Deductions are calculated based on service-level agreements (SLAs) and key performance indicators (KPIs).
- The Project Agreement includes an earn-back regime to incentivize improvement, up to a maximum earn back of 75% of prior deductions. Earn-backs are only possible for exceptional service.

The system integrator is responsible for all maintenance and operational services, including collection and remittance of fare revenue and is required to remit to the MBTA the calculated amount of fare revenue within five business days.[54]

The MBTA AFC 2.0 contract is broadly similar to the contracts of other agencies. However, it builds in performance requirements that shift the responsibility for successful system installation and operation of both back-of-the-house and public facing elements to the integrator. As such, it has a significantly greater scope than the recently-awarded MTA contract, as well as those awarded in 2011 by the Chicago CTA, Philadelphia SEPTA, and Vancouver, BC,im TransLink (Figure 4-2).

● Included in award amount ○ Partial, future, optional, or costs not included in award amount	Boston	New York	Chicago	Philadelphia	Vancouver, BC
Year awarded	2017 (planned)	2017	2011	2011	2011
Published value, with known amendments	$723m (proposed)	$573m	$519m	$141m	$220m
Service area population	3.1m	8.5m	3.3m	3.8m	2.5m
Base ops & maintenance term	10 years	7 years	10 years	1 year	10 years
Implementation financing with ongoing performance payments	●		●		
Cash collection and servicing	●		○	○	○
Bank card processing & fees	●	○	●		○
Field equipment maintenance	●		○	○	●
Retail network & commissions	●	○	○	○	○
New account-based back office	●	●	●	●	●
Back-office maintenance	●	●	●	○	●
New station vending machines	●	○	●	●	●
New gates/turnstiles	●			●	●
All-door boarding validators	●	○			●
Streetscape vending machines	●	○			

Figure 4-2

Comparison of Contract Elements: MBTA AFC 2.0 vs. Other Recent Software as a Service and/or P3 Procurements for MPI

Source: MBTA, AFC 2.0 Systems Integrator Contract, presentation before Fiscal Control Management Board, 11/20/2017, Slide 32, https://cdn.mbta.com/sites/default/files/fmcb-meeting-docs/2017/november/2017-11-20-fmcb-afc2.pdf.

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[54]*Ibid.*, Slide 13

Additionally, the MBTA AFC 2.0 project is forecast to be cheaper over the long term than the estimated cost of delivering this system as a typical capital project, with a more even cost profile and a lower risk of overruns (Figure 4-3).
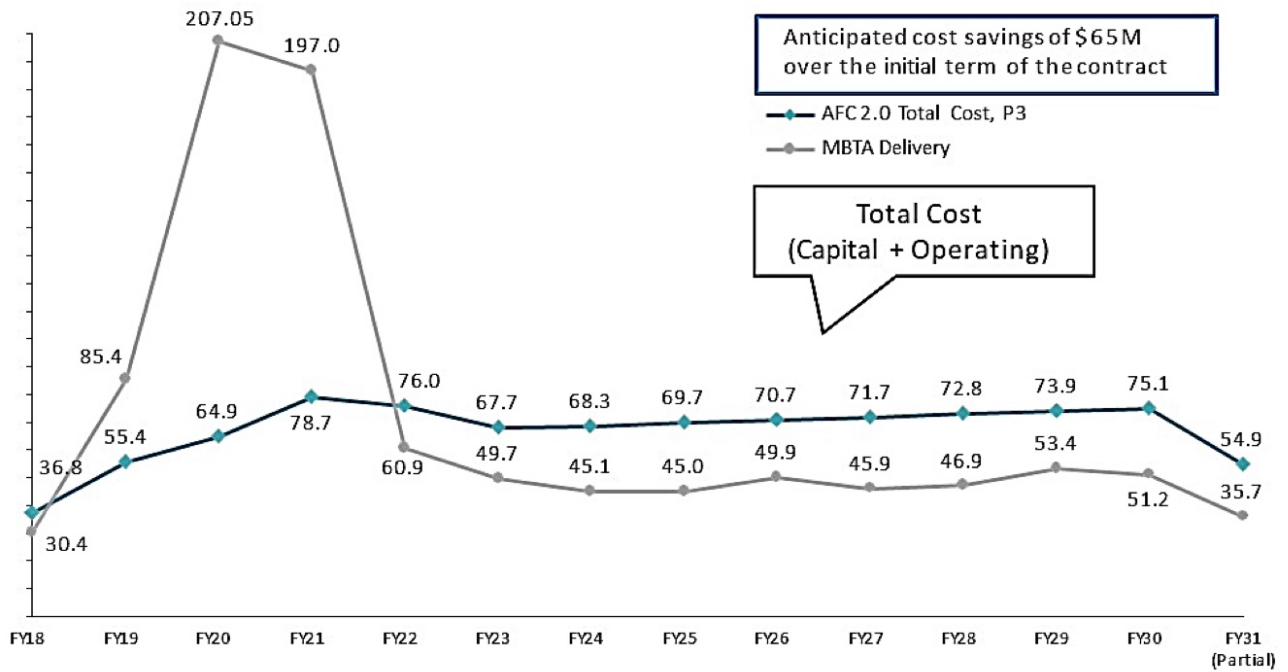

Figure 4-3

Projected Cost Savings to MBTA Resulting from P3 Contract

Source: MBTA, AFC 2.0 Systems Integrator Contract, presentation before \ Fiscal Control Management Board, 11/20/2017, Slide 28, https://cdn.mbta.com/sites/default/files/fmcb-meeting-docs/2017/november/2017-11-20-fmcb-afc2.pdf.

Data Sharing

MPI participants should define what transaction data will be shared among transit agencies and mobility providers. TNCs may be reluctant to provide granular trip data; reaching agreement on a level of aggregation acceptable to all participants is important. Bikeshare operators and other mobility service providers need assurances that they can have access to their customer data if it is collected and managed by a transit agency or other organization. Data sharing was identified by MPI Forum participants as the #2 key issue affecting broad MPI implementation.

Multimodal Payment Products and Architecture

A core tenet of MPI is the issuance and distribution of interoperable payment media. Rapidly-evolving payment technologies have resulted in a range of payment media that transit agencies pursuing payment integration may consider. The most significant advance that will position agencies for further upgrades over time is

the development of contactless payment technology. At present, the emergent contactless media are cards and mobile apps.

Contactless payment is a payment transaction that does not require physical contact between a consumer's payment device and a point-of-sale terminal. The consumer holds a payment device (such as a contactless or dual-interface chip card[55] or a mobile device) in close proximity to the terminal (less than 1–2 inches away), and payment account information is transmitted wirelessly over radio frequency (RF). The consumer's contactless payment device can assume a variety of form factors, including cards, NFC-enabled smart phones, and wearables. Contactless transactions are cryptographically secure and generate a unique code for each transaction.[56]

Transit acceptance of contactless payments also provides greater consumer convenience for both the frequent commuter and the infrequent traveler. In a transit environment that accepts open contactless payments, the consumer can tap a contactless card or NFC-enabled mobile device of choice directly at the subway, rail, or bus point of entry; the need to stop and purchase traditional agency-issued fare media from a vending machine, sales office, or other sales channel is eliminated, as is the requirement for exact change. In addition, as mobile wallets and wearables gain traction, consumers who have NFC-enabled mobile devices will expect to be able to use them wherever they shop and also use other value-added mobile services via the contactless interface.[57]

An open payment system allows transit customers to pay fares with their own contactless payment devices (bank cards, mobile devices) at transit points of entry. Such acceptance potentially can change the way transit riders pay for fares, reducing reliance on agency-issued media such as contactless transit-only media. For transit merchants, such systems can provide various benefits, such as reducing the use of more costly sales channels, reducing the need for costly infrastructure (such as vending machines) and shrinking the supply chain and reducing the resources needed to support transit-only media. It is important to note that many transit agencies are likely to retain some form of agency media, but accepting open payments can minimize this requirement.

Additionally, by leveraging the standards-based technologies used by the broader retail payments industry, transit merchants can deploy systems that are aligned with customer expectations. Such systems can also facilitate interoperability among other transit and non-transit entities without requiring direct systems integration, as customers can use the same device to pay everywhere.

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[55]Dual interface cards allow the chip to be accessed by both the contact plate on the front of the card and the antenna embedded in the card.
[56]Smart Card Alliance, "Contactless EMV Payments: Benefits for Consumers, Merchants and Issuers," PC-16001, June 2016, p. 4.
[57]*Ibid.*, p. 10.

Additional potential benefits for public transit merchants are based on changes to the customer experience. By enabling customers to pay with something they already have, contactless acceptance can increase use of transit by reducing barriers to using public transportation (how do I pay? where do I get a card? a ticket?). Passengers with contactless bank cards can avoid queues and the need to retain separate fare media to access public transit networks while no longer having to search for cash or exact change when traveling. Agencies can even offer the assurance that a customer will always be charged the best fare, similar to the capabilities sometimes offered with closed-loop transit smart cards.[58]

Issuers and mobile wallet providers such as Apple, Samsung, and Google may already have taken the first step toward driving broader contactless acceptance. However, due to the scarcity of contactless point of sale terminals, issuers may still feel that there is not enough merchant acceptance to justify issuing dual-interface cards. Similarly, some merchants may feel that adding contactless cards just for the small lift offered by NFC-enabled mobile payments is not worth the cost and effort. Ultimately, it will be consumers, spurred by speed and convenience, who will drive the demand for contactless payments.[59]

Contactless Cards

Transit customer accounts can be linked to employer benefit accounts, and the value of tax-deductible transit subsidies can be stored in a separate purse. Some transit agencies are accepting contactless identification credentials from employers, universities, or social service agencies.

The financial services industry is strongly in favor of the use of contactless payments in the multimodal setting. By October 2015, the four major U.S. credit card companies (MasterCard, Visa, American Express, Discover) had adopted EMV technology. The use of contactless cards in the U.S. has been low up to this point; only 5% of U.S. cards are contactless, and most/all do not have an offline data authentication (ODA) certificate. Worldwide, however, contactless payments are presently 18% of transactions; Visa predicts the figure will be 50% in three years.[60] The leading card companies support the move toward a cashless environment.[61]

Banks, which issue branded credit cards, are very interested in top-of-wallet benefits from everyday usage of their cards. A bank has the acquiring arm as well as the issuing arm. Any one of those does not make transit a huge priority, typically, for a bank, but all together, it is a great opportunity.[62]

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[58]*Ibid.*, pp. 16-17.
[59]*Ibid.*, p. 20.
[60]S. Perold, Visa Product, Visa NA, "Global Payment Trends and North America," Visa Contactless Payments, 5/16/2018.
[61]Roundtable #1, 3/1/2018.
[62]*Ibid.*

Visa has developed the Mass Transit Transaction (MTT) Model for contactless (open) media. The model uses deferred authorization: first, it authenticates the card as genuine and not on a hot list; then, it authorizes the payment offline. Discounts and fare caps can also be applied offline. There is no financial transaction at point of tap, and this model works for any size transit agency. Visa Ready for Transit was produced in October 2017 as guidance for system integrators and has several elements:

- Standards for point-of-sale devices, such as Square
- In the future, mobile devices will be acceptance devices
- Future capabilities will include tokenization and biometric authentication (which could be built into the card)
- Will enable business-to-business (B2B) payments
- Will be applied to transit applications

Integrators who are certified as Visa Ready ensure that their solutions meet Visa standards. Visa also plans to develop Visa Ready certification for consultants.[63] To date, 30 integrators have adopted Visa Ready and are in the process of being certified, including Thales, Scheidt & Bachmann and Conduent, but not Cubic.[64]

The Visa (MTT) Model posits three levels of contactless payment:

- Retail model
- Known fare transaction – high throughput, ODA with near real time or deferred authorization
- Transit transaction model – deferred authorization (and computation of cost of trip); checks certificate on card to determine if card is valid, thus eliminating most fraud; deny lists done in 15–60 minutes to authenticate transaction

"Card clash" (interference among contactless cards or reading the incorrect card) will be a technical problem as more contactless cards are issued. Customer education on how to present the correct card to the reader will be necessary. Several other examples of the need for intensive and continuing customer education were discussed.

Mobile Apps

Open application programming interfaces (APIs) and software development kits (SDKs) will facilitate interoperability among apps. With respect to multimodal trip planning and booking, both the definition of what defines an MPI deployment and the assumptions of most MPI Forum participants are that mobile devices are to be the tool of choice. The basic rationale for including mobile ticketing

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[63]G. Petersen, VP, Innovation & Strategic Partner, Visa USA, "Are you Visa Ready?" Visa Contactless Payments Summit, 5/16/2018.
[64]B. Sajlovic, Visa, "Deep Dive into Visa's Mass Transit Transaction (MTT) Model", Visa Contactless Payments Summit, 5/16/2018.

and payment functionality in a public transit system's payment options are that the vast majority of riders now carry a smart phone (even more among lower-income demographics); purchasing tickets via mobile phones is far easier and less time-consuming than using a ticket vending machine; and combining trip planning, ticket purchase, and payment into a mobile app provides value-added benefits to the customer and reduces customer frustration.[65] In addition, capital costs for fareboxes and ticket vending machines are reduced and, in some cases, eliminated because the agency shifts these costs to the rider's smartphone.

One transit leader with lengthy experience in transit payment integration, and mobile payments in particular, offered the opinion that the nexus that a mobile ticketing and payment platform provides a nexus of considerable significance with many of the TNC and specialty transportation services such as Uber, Lyft, taxi, microtransit, dynamic carpooling, and even public agency services equivalent to those offered by the TNCs.[66] In his opinion, every transit agency needs to offer a mobile ticketing and payment option. This is a cost-effective, affordable option, even for a small agency, as long as the procurement and contract are negotiated properly. He did not recommend developing an app in-house; although it can be done, it may not be as feature-rich as third-party solutions and most likely will not be able to keep up with the new version releases of the mobile phone operating systems. He also believed that the agency should not limit the products available for purchase to special events and periods of time vs. putting the full range of product types on the app; doing so reduces the benefit of the mobile offering's functionality to riders, forcing them to use multiple methods when one would suffice, and it still requires roughly the same level of staff support. Finally, offering a full range of product types significantly reduces the transaction costs of multiple procurements.

Cards, or Apps, or Both?

At least for the near future, agencies should assume that a solid proportion of customers will want to have cards as an option in addition to mobile apps. Some customers prefer to have both a card and a phone, and some customers will prefer to use cards because of their durability, reliability, and ease of use—and there is no risk of being stranded by a dead phone battery. Also, some customers do not have phones or are non-banked or underbanked.[67]

Of those customers who prefer to pay using a card instead of a phone or vice versa, an unscientific observation period at Starbucks led an expert to conclude that age is not a driving factor in that choice. Within the same apparent age range, some individuals use mobile, some use cards to pay.[68]

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[65]D. Leininger, "Fare Collection," 2/15/2018.
[66]*Ibid.*
[67]Roundtable #1, 3/1/2018.
[68]D. Leininger, comment during "Fare Collection: Implementing Mobile Payment," 2/15/2018.

Payment Settlement and Revenue Reconciliation

In MPI, who should be handling payment settlement? During the cash era of transit payment, transit agencies naturally had the counting and payment functions as part of their management responsibilities. This continued to be the case as systems migrated into electronic fare payment.

With the advent of MPI, the fare management function has become significantly more complex and resource-intensive. First is the matter of dealing with multiple forms of payment in systems in which some modes still accept cash and others involve payment by fare card. Complex fare structures further complicate settlement.

Reportedly, even with the advent of electronic mobility payments and despite the enormous complexity of settlement of single payments across multiple providers that sometimes first require calculation of fares for individual trip segments, some transit agencies prefer to keep the fare collection in-house. One reason given is that the agency values its related customer service relationship with the riding public; a second offered by one MPI participant is insecurity about the potential performance of a contractor.

Testing, Implementation, and Customer Service

There has been little discussion to date regarding system testing. With respect to implementation, a repeated recommendation was to start small, with a pilot-scale implementation and a selected representative group of riders to assess both system functionality and customer ease with navigating the new system.

As of May 2018, participants in FTA's MPI Forums and Roundtables recognized that the term "customer service," as it had been loosely used up to that point, has two dimensions: 1) which entities should have involvement in troubleshooting customer payment problems, and 2) who has legitimate need for highly-sensitive PII data to be shared with them.

Findings: Five Cross-Cutting Issues Requiring Further FTA MPI Program Attention and Research as of May 2018

This section presents the five most important policy and technical issues affecting broad implementation of MPI as identified by stakeholder participants as of May 2018. All five issues cut across the four major topic areas in the MPI Framework.

In the fifth Forum, the FTA MPI project team asked participants which they believed were the most problematic issues impeding MPI implementation. The consensus choices, in order of importance, were:

- API lack of standardization – do agencies have to own APIs to use them effectively?
- Data rights and sharing needs
- Customer service – roles, responsibilities, resources needed
- Data security and tokenization
- Providing service to ALL customers

One fact clearly stood out from these discussions—technology is available to deal with almost any integration problem; the difficult-to-resolve issues are inter- and intra-institutional.

Application Programming Interfaces (APIs)

Two themes fell under this top-ranked issue—access to APIs and API lack of standardization. In the MPI Framework, these themes fall under Planning, Policy, and Governance (Acquisition and Partnership Strategies).

An API allows software to interact with other software. More formally, an API is a set of requirements that govern how one application can communicate and interact with another. APIs are programmed to capture data as specified in the project's business rules. On the web, an API allows for interaction between systems, often for specific use cases. Importantly, they allow for consistent coding

in stable environments, allowing for replicable functions to be delivered the same every time the request is submitted with reliability and predictability.[69]

An open (or public) API is a publicly-available API that provides developers with programmatic access to a proprietary software application or web service. In contrast, in a proprietary (closed) API, the owner of proprietary software exercises certain exclusive rights over the software. The owner can restrict use, inspection of source code, modification of source code, and redistribution.

Access to APIs

A transit agency IT expert asserted that open APIs are good and necessary and need to be unrestricted; mobile payment software/app developers concurred. One stated that agencies appear to be specifying open standards and open APIs, "which is great." In their view, APIs need to be repurposable—i.e., usable and interoperable across a variety of different platforms. The core business relationship at issue is between the agency and the integrator. The reasons given for taking this stance were the following:

- In the past, when the contract with an integrator did not require APIs to be open and were proprietary, any changes or updates the agency wanted to make carried an "exorbitant" price tag.
- If the maker of a proprietary code that is unique to the agency goes out of business, the agency has no way to retrieve either the code or its data; agencies need to avoid vulnerability of a provider going away.
- MPI encourages connecting systems via the web in a clean, reliable way. For the industry to thrive and advance, developers should have open access to the APIs.

A major integrator asked, "What level of data are you looking to control in the API? Going deeper into the back office? How deep do you want to go to have interoperability across the agencies?" Payment integration involves a large number of APIs to execute the technical business rules for various subsystems and functionalities. Sector participants initially proposed solutions that other sectors found problematic.

With transit agency ownership of the APIs, the agency could put the API code out on a Creative Commons open source license that can set terms for usage, but there should be no restrictions after first use – it should be truly open so people can use it. The two payment developers agreed that open APIs are desirable and necessary for the field to advance, as "you wouldn't want to [have to] create a new API for every platform. However, he did not believe that ownership of the API by the integrator, the transit agency, or anyone else is good for business. The representative from a major mobile payment developer opposed the idea, saying that anyone, including the transit agency, owning the API is bad for business.

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[69]K. Sandoval, "What is the difference between an API and an SDK?" Blog, Nordic APIs, June 2, 2016, https://nordicapis.com/what-is-the-difference-between-an-api-and-an-sdk/, accessed 5/4/2018.

A major integrator floated the idea of a data warehouse controlled by a neutral party in which each system needing the interface could retrieve the data. A transit agency participant rejected the idea, believing that this would still require an agreement on how the APIs are licensed and used.

Further discussion clarified that what the transit agency that first proposed agency ownership of the APIs actually desired is access to the APIs, not the back-end software, and being able to take over the API operationally, but not technically. This includes assurance that the agency can continue to integrate with new providers and talk to other devices that have yet to be developed; for the integrator, not the agency, to own the role and responsibility of performing upgrades to APIs necessitated by evolving technology; and not being "left in the lurch" if an integrator goes under.

On the last point, a rep from a major bank card advised due diligence in procurement, ensuring that the prospective integrator is financially healthy, and that all parties on the integrator's proposed team will perform reliably and on time because they have documented experience and a successful track record.

API Lack of Standardization

There was agreement across the industry sectors that standardization of APIs is essential for widespread enablement of MPI. An executive of a major transit agency of the MPI effort for one of the most advanced planned deployments spoke about the need for "relatively standard API endpoints for payment," analogous to the role of GTFS in enabling sharing of real-time transit trip information. In his opinion, getting to that same level with payment APIs is the way to get to multimodal integration. The problem is that each location is setting up its own system APIs in a way that is not guaranteed to be compatible with those of the systems in other locations: "Chicago has its system with its APIs, San Francisco has others—we end up with different worlds. And when we want to integrate with other modes such as TNCs or be able to use a Boston card in New York City, we can't, because of divergence and no standard framework."

A developer of apps for mobile seamless transit travel planning and payment asserted that non-standard APIs are the biggest challenge to mobility payment integration. TNC participants indicated that standardizing MPI APIs would clear a major hurdle in their MPI participation.

Discussion concluded in principle, noting that the standards industry members want are performance standards about what can be expected of an API, not technical standards. As another mobile app developer said, "The key point for agencies is, we negotiate with the agencies for the APIs, and the APIs have to do what they want them to do. A third party tests the API to determine whether it does what it is supposed to be doing, comments are clear, etc. I worry about tech standards that it would look like a phone book and take forever to work out."

APIs: FTA MPI Program Opportunity for Mitigation

Access to APIs

Regarding control of API, transit agencies seeking MPI services need to understand the software-as-a-service procurement and project management model and make use of the P3 principles of risk sharing and incentivizing continuing quality performance. This approach includes due diligence practices for ensuring that the selected integration team is financially secure and stable.

The FTA MPI Program can play a leadership role in compiling and disseminating this key information. For example, recent procurements by the MBTA and the New York MTA are emblematic of putting these principles to effective use to the benefit of the agency, its partners, and its customers. The procurement processes used by the two agencies could be documented in depth and then distilled into a guidance document for dissemination by the FTA MPI Program.

Establishing Performance Standards for APIs

Participants generally agreed that developing consensus on performance standards for APIs would save a tremendous amount of time for procurements and design and that the likelihood of future agency adoption of the MPI model would be increased. Participants supported the idea of the FTA MPI Program convening and facilitating discussion involving all the sectors toward this goal.

Data Rights and Sharing Needs

Data rights is a major issue today that is not limited to the mobility sphere. At a societal level, the recent revelations concerning the depth of personal data captured by Facebook, Google, and Amazon and the monetization of those data for purposes that extend far beyond marketing in its traditional sense have raised profound concerns about personal privacy.

In the FTA MPI Forum and Roundtables, participants described how data sharing has been a challenge for agencies, integrators, TNCs, and bikeshare providers. For example, the monetized value of customer data as a competitive tool to TNCs and bikeshare companies was seen as a security as well as a privacy risk, because the personal data could be used to attract them to one provider over another. The issues under this heading are:

- Who owns the data captured when an individual searches for trip options, makes a selection, pays for the trip, and completes the journey over multimodal segments?
- What boundaries should be set around uses of the data? Can the data be shared? Can it be sold?
- Which entities in the ecosystem need to have sensitive data shared with them for legitimate purposes?

- What are the legal and regulatory requirements for protection of customer privacy (PII and location data)?
- For sharing recognized by the ecosystem as legitimate to occur, what information must the customer receive in advance, and what mechanisms for enabling the customer to give permission for data sharing should be specified as system requirements?

A later subsection addresses the related issue of what technical solutions are available or in development to protect and keep secure the identity of the traveling customer who is making a payment in an integrated system throughout the entirety of the payment and settlement process.

Who Owns the Data?

There are three separate core relationships concerning data ownership issues:

- Between mobility providers and integrators – concerns were expressed by transit agencies, integrators, TNCs, and bikeshare providers
- Between providers – in particular, between transit agencies and TNCs
- Between service providers and banks that process payments – this topic crosscuts with customer service issues discussed below

These issues differ in history, dynamics, complexity, and probability of resolution.

Transit Agency–Integrator Relationship

Historically, the tension around this issue for some participating transit agencies appears to be an artifact of their experience with transitioning to AFC under contractual arrangements under which the APIs were the intellectual property of the integrators and ownership of the data was not established in advance. Some agencies found themselves being asked to pay to obtain what they viewed as their own data.

In the case of bikeshare, Motivate, which operates more than 70% of the bikeshare activity in the U.S., has a policy of making its data open to not just the cities with whom it has contracts but with the public. From a different perspective, a bikeshare participant stated that he would feel extremely vulnerable if an integrated account-based system meant that his critical business data, including his customer and payments data, were stored outside of his business. He would need a guarantee of permanent ownership of and access to those data; otherwise, he would lose access to his customers. Although the prospect that his business might get many new customers because of the integration relationship was positive, he did not see that as an adequate tradeoff.

The issue between the agency and integrator falls within the Framework under Planning, Policy, and Governance (Acquisition and Partnership Strategies, Data Sharing Agreements, and Privacy Agreements).

Transit Agency and Non-Traditional Mobility Provider Relationship

Reportedly, part of the reason that transit agencies are meeting with steep resistance from TNCs to integrating with them is that the TNCs do not want the agencies to have access to their routing and rider volume data or to their fee structure, as these are the core of their competitive strength.

A participant from a major transit agency was concerned about the effect of potentially sharing commuter data with TNCs for two reasons. First, he saw the possibility that a TNC could use agency data strategically to compete with transit, moving ridership from a more efficient mode to a less efficient one, thereby increasing congestion. Second, he saw major risks in sharing commuter data with what he termed a "very under-regulated agency." A second agency participant was also suspicious of the TNCs, but still saw some opportunity to come together for a common goal.

A participant from a third agency that is a leader in MPI said that her agency was looking to TNCs and a microtransit provider to provide service to a transit-poor area of the city. The agency wants to work with them but will negotiate to make sure any data generated through payment integration are owned by the agency.

However, some agencies have pilot studies running that involve TNCs for the purpose of bridging the first/last mile gap with fixed transit (DART) and providing on-demand, same-day subsidized paratransit services (MBTA). What data are shared by the TNCs with the agencies and what the transit agencies encountered by way of TNC willingness to share data has not yet been described in discussion.

The issues between agencies and other providers fall under Planning, Policy, and Governance (Multimodal Mobility Service Agreements; Multimodal Pricing Policies, Fare Rules, and Transfer Agreements; Multimodal Subsidies, Discounts, and Incentives; Co-Marketing; Acquisition and Partnership Strategies; Customer Service Agreements; Data Sharing Agreements; Privacy Agreements; and Risk Distribution).

Mobility Service Provider–Financial Institution Relationship

If an MPI customer contacts a bank directly because he/she paid for a multimodal journey and there was a problem on one of the segments (for example, paying for bikeshare, then getting to the dock and no bike available), the bank's customer service representative needs to have the data on the specifics of the journey to help the customer or otherwise inform them of where they spent their money if transfers were involved.

The crosscutting issues between service providers and banks fall under the MPI Framework topics of Planning, Policy, and Governance (Customer Service Agreements and Data Sharing Agreements); Payment Settlement and Revenue Reconciliation; and Testing, Implementation, and Customer Service.

Data Ownership and Sharing: FTA MPI Program Opportunities

General Opportunities

- What data are gathered? Are rights to the complete data set at issue in all instances? Explicit identification of which data are relevant to each dimension of the issue would bring improved clarity to the discussions.
- The idea of creating consensus on data consistency or even standards analogous to GTFS, but for data and payment formats, was raised and should be further explored.
- There are examples of systems in which attention to protecting the data privacy of individuals is going beyond privacy agreements in principle to defined technical solutions:
  - The multi-state EZ-Pass automated toll collection system separates account information from customer PII.
  - In its new AFC 2.0 integration contract, the MBTA is decoupling account data and PII in a way that only the customer can re-link them.
- Collection and dissemination of best practices in MPI throughout the field would offer solutions to avoidable problems.

Transit Agency–Integrator Issues

MPI Forum stakeholder participants believed it would be possible, under FTA auspices, to jointly develop recommendations for general practices on data rights. As the representative from a major mobile payments consultant said, "There's agreement on most of the big issues. You can't sit down and have a frank discussion in the middle of a contract negotiation. It has to be outside this."

With recommendations on data rights as a basis for negotiation in place, data ownership issues between the public transit agency and integrator may be resolvable through the procurement process, using software-as-a-service and P3 models.

Transit Agency / Non-Traditional Provider Issues

- The DART and MBTA pilot project experiences should be probed in detail to better understand the issues TNCs have with data sharing.
- One MOD Sandbox participant described a potential approach to the TNC data-sharing issue as creating trusted partner status for a private-sector intermediary between the transit agency and the TNC; this has reportedly been an effective solution in Europe.
- TNCs do not want proprietary data underlying their competitive advantage to become available.

Under the MOD Sandbox agreement, Valley Metro in Phoenix is obligated to report certain requested data to the project's independent evaluator. Additionally, all Valley Metro activities are subject to the Arizona Public Records

Act, and, because the project is funded by FTA, its records are also subject to Freedom of Information Act (FOIA) requirements. In May 2018, Valley Metro asked its integrator, Routematch, to negotiate directly with the TNCs under a trusted partner status agreement to arrange for their TNC transfer of data to Routematch. This arrangement would involve Routematch signing a Non-Disclosure Agreement (NDA) with each TNC. Under this agreement, the TNC would provide its complete data stream to Routematch, which would filter it to capture the data needed by Valley Metro. Valley Metro would then link to RouteMatch for communication of those filtered data only. At the time this scan was completed, those negotiations were ongoing. Valley Metro believes that this contractual arrangement would result in information transfer between Routematch and a TNC—two private-sector entities—that would not be subject to either the Arizona Public Records Act or FOIA.

Customer Service

This issue has two dimensions: 1) which entities should have involvement in troubleshooting customer payment problems, and 2) who has a legitimate need for highly-sensitive PII data to be shared with them.

The cross-cutting MPI Framework topics are Planning, Policy, and Governance (Customer Service Agreements and Data Sharing Agreements); Payment Settlement and Revenue Reconciliation; and Testing, Implementation, and Customer Service.

Roles and Responsibilities

This issue was raised under a scenario in which a customer has paid for a joint ticket covering a multimodal journey. Whose problem is it if the customer buys a journey that includes bikeshare and there is no bike waiting; whom should the customer call? Customers need to know from whom to seek support and how when something goes wrong with a leg in the multimodal journey for which they have paid.

Who has Legitimate Need for Highly-Sensitive Data?

To provide customer service, transit agencies and financial institutions need highly-detailed trip information to resolve problems. The identity of the individual making the payment for the trip and the individual's journey data that indicate their location are considered PII.

According to a transit agency representative, because it is launching an integrated payment system, it now must figure out customer service, which is not simple. Giving the agency's customer service agents enough tools to resolve issues

quickly has changed how it has gone about the integrations, especially with respect to transfers. Sharing trip data is a necessary element of customer service.

Per a major bank card provider representative, this is an issue from the payment perspective, and the financial institution also potentially needs to know what the journey is. For example, if there was a surcharge for a bike and then it is not there, the financial institution needs to have that journey information; just loading money into the account without associated journey information leaves the financial institution at a disadvantage.

Privacy and Security

The financial payments industry is working on standards and technology for tokenization of payments.

FTA MPI Program Opportunities for Mitigation

Under the guidance of the FTA MPI Program and using its organizational capabilities, gathering participants across all sectors to develop consensus guidelines on what constitutes a legitimate need to have access to highly sensitive personal data could be highly productive. As data privacy and security are popular topics, the FTA MPI Program will also consider creating a forum for discussion between members of the MPI ecosystem and members of the public whose data they are entrusted with. Topics may include:

- Consensus-based recommendations on creating opt-in rules so customers can opt-in, thereby giving their permission for access by entities and individuals with an approved need to know.
- Guidelines for all players in the MPI ecosystem on the information that must be provided to customers to enable them to understand the issues fully and make informed choices.

Data Security and Tokenization

At issue is how to maintain the security of PII data elements and preserve PII privacy while still being able to track customer identity in relation to the flow through the payment system. The technical solution, in progress, is tokenization.

According to a major bank card provider and leader in MPI-related initiatives, the major card providers have a standard way to tokenize their customers. The problem is that each card only tokenizes its own customers. EMVCo is trying to develop an anonymous 16-digit reference number (Payment Account Reference, PAR) that could attach to the token. Through that PAR, data on travel segments would be preserved, but anonymity also would be preserved. EMVCo's goal is to develop the specifications for transit payment first and then work them out to the wider payment community. This approach creates "breadcrumbs" that leave a figurative trail behind the individual customer and can distinguish between separate users on the same account. This can detect people on the same

account who share a phone to reach a fare capping level faster than one of them alone could; they should have separate passes. This takes advantage of the PAR standard; its use in transit is being worked on first by EMVCo.

FTA MPI Program Opportunities for Mitigation

The FTA MPI Program can work with the payments industry and EMVCo on the availability of information that describes in simple lay terms how tokenization and PAR work. The objective of obtaining and disseminating this information is to help the public understand the techniques the industry is developing and will continue to develop to protect the privacy of its customers. They will then be equipped with the knowledge needed to decide whether they feel these protections are adequate.

Providing Service Equitably to All Customers

This was listed by the participants as the fifth most important issue. However, with two exceptions, it has received little discussion to date. Explicit discussion of participant experience and recommendations under this topic were limited to the following:

- How to assure under MPI that non-banked and underbanked customers have access to alternative means to be full consumers of an integrated, account-based system.
- Equitability of fare capping, as lower-income customers are more frequently compelled to pay by the ride because they do not have the funds at one time to take advantage of discounted weekly or monthly passes. With fare capping, they can pay as they go without exceeding what they should pay if registered for the pass.

These agencies are also legally and ethically responsible for providing services to special populations, including persons with disabilities. The population of older adults in need of accessible public transportation is growing with the aging of the "baby boomer" generation; the technical savviness, transit habits, and physical (as well as cognitive) capabilities of this cohort are distinctly different from non-baby boomers. A major goal of the FTA MPI program is to erase the bifurcation between special needs travelers and others. Every mobility system developed today has to address the needs of all riders. Transit programs must comply with equity requirements of Title VI to provide access to services for all potential riders.

Accommodating Non-English-Speaking Customers

As an FTA regulatory matter, public transit systems with multicultural populations must assess the linguistic needs of their riders to ensure their participation in the system. Linguistic issues are relevant in relation to neighborhood outreach, signage

on public transit property and on-board the vehicles, and, in the immediate context of the FTA MPI program, in relation to the instructions and customer education media associated with being able to plan a journey and pay for it.

The MBTA reported that for AFC 2.0, the agency went beyond the minimum level of satisfactory provision in FTA's guidance. Because their procurement was predicated on performance-based requirements, the MBTA quantified its expectations. The systems integrator must determine the extent of non-English speaking customers throughout the system on a granular geographic level. If more than 1% of a target area is non-English, then any machine associated with payment, such as a Ticket Vending Machine (TVM), has to accommodate them. the MBTA's upgraded system is being configured to present information in five languages now, but if more are needed, the integrator must provide them.[70]

Accommodating the Visually- and Hearing-Impaired

The issue of language accessibility also applies to those who are visually- and hearing-impaired. The MBTA AFC 2.0 Request for Proposals stipulated the requirement that all MBTA TVMs must provide both braille and raised letters for ease of reading by the blind.

Providing Payment Options for the Non-banked and Underbanked

Public transportation agencies have legal and ethical responsibilities to serve all travelers, including those who do not have credit cards, bank accounts, or smart phones compatible with the electronic fare payment concept.

Purchasable Fare Cards

In MPI deployments, it is critically important to ensure that travelers have conveniently accessible options for using cash to pay for mobility services. Currently, this often takes the form of providing locations (e.g., local retail stores) for using cash to purchase a prepaid stored-value fare card or to add value to a transit account. As open-payment MPI becomes increasingly prevalent, ensuring equitable service delivery to non-banked customers will entail the provision of locations to use cash to add value to a mobility account that serves multiple modes.

A solution for the non-banked was to offer the physical analog of gift cards. In some systems, this is a card with a value chip only; in other cases, such as San Diego, if customers do not have a credit card to link to a transit account, they will use the PayNearMe solution from Moovel to identify the nearest retail store, where they can add value to their card with the cashier. In other cases,

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[70]D. Block-Schacter, MBTA, personal communication, 12/4/2017.

customers can establish a transit account using cash; to add value, they go to the retail outlet equipped with a terminal that the cashier uses to credit the account in the amount of cash the customer gives them.

The MBTA made the decision to eliminate on-board payment in cash, which particularly affects low-income customers who tend to pay cash by the ride because they do not have sufficient income to afford monthly or weekly passes. (The MBTA's new fare payment collection system will not have fare capping at the time of launch in 2020.) Consequently, setting the spatial requirements for the location of retail outlets was essential.

The MBTA set quantity standards for where cash could be used for purchasing fare cards and established how many machines would be needed in each location—95% of customers must be able to use cash within 1000 feet of a bus stop, and 98% must be able to do so within 2000 feet.

In the final system plan, customers can obtain an MBTA-branded fare card or otherwise pay three ways:

- Using a vending machine at MBTA stations and bus stops
- Purchasing pre-paid cards at point-of-sale (POS) terminals at retailers; the MBTA will have direct integration with large retailers including Walgreen's, CVS, and Dunkin' Donuts. FirstData will be the payment processor for small businesses
- Using a purpose-built Android app (MBTA's market research found that non-banked customers tend to have inexpensive Android phones rather than more expensive iPhones)[71]

FTA MPI participants gave several examples showing that estimating needed stocks of purchasable fare cards and assuring their replenishment has been unexpectedly complicated. TriMet reported encountering a steep learning curve in relation to how the gift card industry operates and manages replenishment. Getting the card into stores was problematic for TriMet. San Diego concurred, adding that it learned from TriMet's experience; directly servicing a target of 500 outlets across 5 different retail outlets would have been overwhelming for MTS, which is seeking one major player to sub-manage the five relationships. According to the San Diego participant, two private-sector organizations (BlackHawk and GreenDot) are capable of providing the needed service.

UTA, with approximately 300 locations, commented that certain retail convenience store chains are amenable to taking on the task because of extra sales due to the higher margin purchases by riders who come in for the transit card. UTA started with 200 locations, but a significant challenge was that

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[71]D. Block-Schacter, MBTA, personal communication, 12/4/2017.

merchant internal distribution channels are different. For example, Walgreen's is responsible for its own replenishment under its own channels; therefore, neither UTA nor its contract card manager, InComm, has direct control over that. If a store is out of cards, it is difficult to bring pressure to replenish; those over which InComm has direct control work better for that reason.[72]

Early in 2018, WMATA received word that CVS, a major retail location for purchase of Metro cards, had made a business decision to no longer support that activity after WMATA's lengthy negotiations regarding cost to the retailer failed.[73] However, in May 2018, WMATA was able to reach agreement with CVS, resolving differences and addressing the retailer's concerns, assuring CVS's continued sale of Metro cards.[74]

Mobile

Adding value to an account using a mobile app requires sophisticated integration. Two participating agencies, DART and Los Angeles Metro, described how this works in their systems. In Dallas, customers can add value at a 7-Eleven or a number of other retailers in the service area. If a customer wants to put $20 onto the app, the app shows the location of the nearest retail stores and provides a barcode. The retailer scans the barcode to link to the customer's account, and the desired value is added. DART was expected to release the necessary Interface in May 2018. LA Metro reported that non-banked customers can go into a CVS and use their barcode to add value. Additionally, a POS system is being developed; when installed in retailer stores, the system will allow users to tap their phone and receive a discount in the account on retail purchases.[75]

A number of FTA MOD Sandbox projects as well as mobile systems already in use by established MPI deployers are attempting novel solutions to meet the needs of the special populations and areas described above. The FTA MOD Sandbox projects will undergo independent evaluation, and the findings and lessons learned will be reported.

FTA MPI Program Opportunities for Mitigation

Through selection of demonstration projects, the FTA MPI Program can seek innovative, effective service provision to travelers with specific needs. The rich lessons learned shared by MPI Forum and Roundtable participants on the complexities and pitfalls of the "gift card" model is important to share with any agencies and planning organizations considering MPI.

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[72]Forum #3, 2/26/2018.
[73]https://www.washingtonpots.com/CVS-to-end-smartrip-sales-and-other-metro-card-services-heavily-used-by-low-income-riders/?noredirect=on, accessed 5/10/2018.
[74]https://www.nbcwashington.com/news/local/CVS-agrees-to-continue-selling-SmarTrip-cards-482636411.html.
[75]Forum #1, 12/18/2017.

Mobility Payment Integration (MPI) Program: Demonstration and Deployment Planning Framework

1. Policy and Governance

a. <u>Needs assessment</u>

Community engagement provides an informed sense of the requirements for the payment system. It also gives insight into what education and public outreach will be needed to enable current and new customers to adapt to using the new system and to give them the necessary reassurance regarding the systems security and privacy protections so that they will be willing to use it.

Best practices for needs assessments and scoping alternatives include benchmarking with other transit agencies, peer reviews, and regional workshops with stakeholders and technology providers.

Transit agencies have found that it is important to use many types of outreach to reach stakeholders and elicit requirements, including focus groups, community meetings, rider surveys, field interviews, etc.

Transit agencies need to decide what payment system strategy will best meet regional needs. For example, if partnerships are being developed with other mobility providers for first/last mile and other types of service, the payment system strategy could support that with integrated trip planning and multimodal payment apps and accounts. If regional goals include reducing congestion, the payment system could provide incentives to use sustainable modes.

The condition of legacy equipment is a factor in deciding whether to modify or add to an existing system or replace it with a completely new payments system. If legacy payment systems have reached the end of their useful life or cannot support changing fare policies, transit

agencies may decide to replace their card-based system with an account-based system to provide additional flexibility.

Providers of mobility services should consider developing multimodal agreements to coordinate their service offerings to optimize end-to-end travel for their customers (e.g., first/last mile, paratransit mobility services, etc.).

b. Multimodal pricing policies, fare rules and transfer agreements

Many transit agencies are attempting to simplify fare policies and rules before implementing new payment systems.

Transit agencies and mobility service providers need to determine how trips involving more than one mode will be priced.

Policies and programs related to payments should be aligned with regional transportation goals.

Transit programs must comply with equity requirements of Title VI to provide access to services for all potential customers.

c. Multimodal revenue sharing agreements

It is advantageous for service providers to agree in advance on the apportionment of revenues collected for trips involving multiple providers.

It is also helpful for providers to agree on the time allowed to settle transactions (daily, weekly, etc.).

d. Multimodal subsidies, discounts and incentives

Transportation management agencies are responsible for setting mode-share and congestion reduction goals. Pricing and incentives on mobility options may be used to help reach these regional goals. MPI can help apply incentives to all mobility services in a holistic way to support regional goals.

Transit agencies are subsidizing mobility services provided by TNCs, micro transit, and taxis where the services can be provided more cost-effectively than services provided by the transit agencies.

Subsidies can be provided to mobility providers who serve selected groups of customers. The source(s) of subsidy payments (i.e., transit agency, human service agency, employer, other) must be determined, and

the customer's account may have to include separate purses to comply with tax regulations.

Many transit agencies are adopting fare capping policies, which could be extended to cover multimodal trips.

A challenge to MPI is that incentives like tax deductions for employer-provided transit benefits may not apply to other forms of mobility, like TNCs or bikeshare, unless Federal tax rules are modified.

e. Co-marketing

Transit agencies, mobility partners, and other organizations may cooperate with joint marketing campaigns, which could, for example, include discounts at retailers or events to encourage ridership, attendance and sales (e.g., retailers in Montreal and Portland, Texas State Fair).

f. Governance structure

Procedures and organizational structures are needed to develop multimodal payment agreements, pricing, and travel demand management strategies, data sharing, revenue and cost sharing, etc.

There is an opportunity to define the roles of public agencies and other service providers as mobility managers (i.e., building customer relationships, maintaining user experience, overseeing performance and integration). Is one organization going to coordinate all mobility services or be a single point of payment—as in the Mobility as a Service concept—or is a more decentralized approach preferable?

For MPI to succeed, transit agencies and mobility service providers must agree on how multimodal payments in the region will be processed, and who will reconcile payments among the service providers.

g. Procurement and partnership strategies

Open, non-proprietary specifications, such as performance requirements for "real-time" account-based systems, will enable transit agencies to purchase equipment competitively, accept more types of payment media, and accept new technology as it evolves.

Public-private partnerships like the one created by the MBTA can reduce the amount of public capital funding required and risks to the transit agency.

Licensing agreements may be needed for mobile apps and other software.

Transit agencies must determine if the sources of funding they are using allow them to penalize payment processors if performance specifications are not met.

Payment system integrators must understand and comply with the transit agency's financial and accounting requirements. Transit agencies could consider requiring that the contractor involve a certified accountant to ensure that these requirements are met.

Transit agencies may want to pre-negotiate agreements with system integrators before contracts and agreements are finalized to make sure that mutually acceptable terms are included, and the transit agency retains flexibility to expand the payment system to other mobility service providers in the region.

h. Customer service agreements

Transit agencies, mobility service providers and payment processors must determine who will be responsible for different types of customer service. In some regions, a single call center handles customer inquiries for all types of transit payments. If the customer issue involves another mobility service, such as bikeshare, the transit agency and the bikeshare operator need to agree on which organization handles each type of customer inquiry (service, equipment problems, payment issues, etc.). Customers must be given clear guidance on which organization to contact for different types of inquiries.

Payment processors may need access to certain non-financial trip data (e.g., modes, trip origins and destinations, dates and times of trip segments) in order to resolve customer inquiries.

i. Data sharing agreements

MPI participants should define what transaction data will be shared among transit agencies and mobility providers. TNCs may be reluctant to provide granular trip data—reaching agreement on a level of aggregation acceptable to all participants is important.

Bikeshare operators and other mobility service providers need assurances that they can have access to their customers' data if it is collected and managed by a transit agency or other organization.

j. Privacy agreements

Multimodal mobility and integrated payment services will create potentially sensitive data about customers and their travel. Transit agencies and their partners need to define how customer privacy will be assured. It would be

beneficial if transit agencies and mobility service providers would develop a coordinated policy or framework for privacy agreements.

Customer data must be managed to ensure that privacy is not compromised. Some transit agencies keep historical journey data separate from personally identifiable information. Many organizations use techniques like anonymization and aggregation to analyze data without compromising customer privacy.

The privacy and data policies must be clearly communicated to customers regardless of what type of mobility service or fare media they use. Ways to do this with all payment distribution channels and partners must be developed, such as the retailer that distributes transit payment media.

k. System-wide security policies

Security policies and specifications must be defined for all equipment and payment media. Methods such as tokenization will ensure that customer data are protected. The approaches to security and tokenization can be coordinated to ensure compatibility among all organizations participating in the payment system.

The level of security of the overall system architecture can be verified after implementation to ensure compliance with security requirements. Many organizations use an independent third-party security firm to verify that security risks have been adequately addressed.

Payment systems, processes, and organizational capabilities must be developed that will minimize disruptions from equipment failures or cyber-attacks. The resiliency of the payment system should be addressed as part of the business continuity plans for the transit agency and their mobility and payment system partners. Payment system partners can conduct periodic testing to ensure that vulnerabilities have been minimized. They can conduct table-top exercises to ensure that they are prepared to respond and recover from disruptions. Relationships with cybersecurity information sharing organizations, law enforcement agencies, and vendors will be beneficial to expedite the response to cyber incidents.

l. Financial Considerations and Constraints

The decision on whether to design and implement a new account-based, open-architecture multimodal payment system or, instead, to layer that system on top of an existing card-based system may depend on availability of funds and the relative cost-effectiveness of modifying vs. replacing the card-based system to meet the requirements of the region.

Some agencies (e.g., San Diego MTS) have decided that a new system would meet their needs more cost-effectively than incremental changes to the existing system.

Other agencies (e.g., LACMTA) are implementing a hybrid program which adds customer accounts to their legacy card-based system. LACMTA feels that this will be a more cost-effective solution, and that the account-based system will enable them to link to bikeshare, TNCs, microtransit, car-charging stations, etc.

2. Multimodal Payment Products and Architecture

a. Issue and distribute interoperable payment media

Open APIs and SDKs will facilitate interoperability among apps.

Mobile apps can be linked in several ways:

- Link trip planning and booking to payment
- Deep link from transit agency trip planning app to mobility provider apps (e.g., DART Go Pass to Uber and Car2Go)
- Third-party or white label trip planning app linked to mobility provider apps and transit mobile ticketing (moovel, GoDenver, etc.)
- Deep links from TNC app to transit mobile ticketing, car share, etc. (e.g., Uber to Masabi mobile transit ticketing and Getaround car share
- Transit card emulation on third-party trip planning and payment app (e.g., Mifare transit card emulation on Google Pay in Las Vegas, Hop Fastpass account-based virtual card on Google Pay in Portland)

A transit payment app collects funds for other mobility services (e.g., TAP mobile app and TAPforce account at LA Metro or Ventra account at CTA used to pay for bikeshare)

b. Establish multimodal payment accounts

Some transit agencies want to manage their customer accounts in order to maintain the relationship with the customer and provide incentives to manage travel demand.

Transit agencies are creating accounts, which can be part of account-based payment systems or accounts linked to a card-based payment system.

Transit accounts can be extended to include other mobility services. System integrators or other third parties are extending their "fare engines" to provide middleware to calculate pricing for multimodal, multi-provider journeys.

In some regions, mobility management organizations may provide a Mobility as a Service (MaaS) platform, which aggregates mobility offerings for the region into a mobility marketplace and provides a single point for booking and payment of any type of mobility service. Multimodal platforms will have middleware to connect the service providers, and to manage pricing computations to provide the customer with best value for multimodal journeys.

Transit customer accounts can to be linked to employer benefit accounts and the value of tax-deductible transit subsidies stored in a separate purse. Some transit agencies are accepting contactless identification credentials from employers, universities or social service agencies.

Transit trip planning apps can be "deep-linked" to the apps and accounts of TNCs and other mobility providers.

"Standards" for payment data and accounts are needed to facilitate movement of funds between accounts (such as a "GTFS" for payment information).

System integrators and account processors should meet performance specifications for account reliability and response times.

c. <u>Accept and validate multiple types of payment media</u>

The interoperability of payment technologies should be certified.

d. <u>Identify travelers and access payment accounts</u>

e. <u>Provide qualification-based allocation of trip costs to multiple programs (e.g., Medicare, local programs, ADA)</u>

3. Payment Settlement and Revenue Reconciliation

a. <u>Verify traveler funds availability</u>

b. <u>Authorize funds transfer</u>

c. Process payments settlement

d. Provide refunds

e. Enable data sharing and analytics

4. Testing, Implementation, and Customer Service

a. System acceptance testing

Extensive testing is critical before implementation, and launch dates should be kept flexible to allow for resolution of problems.

b. Customer outreach and education

Customer outreach campaigns are needed at each stage of the project so that customers understand the pricing policies; use of trip planning, booking, and payment apps and payment media; customer services; etc. It is important to get customer buy-in for changes to payment; use of proof-of-payment, buying media at retail outlets, using financial payment media, etc., can be difficult for customers to understand initially.

A variety of methods can be used to inform customers about new payment systems. Public outreach can include meetings with stakeholders, hiring community engagement staff, forming an internal agency outreach group, developing engagement plans, and documenting lessons learned.

Some transit agencies and mobility service providers conduct widespread blitz campaigns during the launch of new services, with customer service agents, mobile service vans, and public service announcements used to educate customers. Uniformity of messages and the type of communication used may help reduce customer education costs.

Some agencies feel that it is easier for customers and transit staff to adapt to incremental implementation of new capabilities. Simplifying the message and making new payment capabilities intuitive to the customer will reduce barriers to customer adoption.

It is especially important to educate customers about new fare policies, such as discounts, incentives, and multi-agency or multimodal pricing. Many agencies are implementing fare-capping policies, but some have found that it is more understandable to customers if explained with terms like "earning your pass."

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