APTA STANDARDS PROGRAM
WHITE PAPER

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Revenue and Data Working Group

Open Data and Open Loop Payments Standards for Transit

Abstract: This white paper can be used by public transit agencies to identify existing standards related to open fare collection and open data as well as organizations that maintain standards used in the transit industry.

Keywords: fare collection, open data, open-loop payments

Summary: This white paper provides transit agencies with a consolidated summary of active standards organizations who are making substantial contributions to open data standards in the transit industry.

Foreword

The American Public Transportation Association is a standards development organization in North America. The process of developing standards is managed by the APTA Standards Program's Standards Development Oversight Council (SDOC). These activities are carried out through several standards policy and planning committees that have been established to address specific transportation modes, safety and security requirements, interoperability, and other topics.

APTA used a consensus-based process to develop this document and its continued maintenance, which is detailed in the manual for the APTA Standards Program. This document was drafted in accordance with the approval criteria and editorial policy as described. Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

This document was prepared by the Revenue and Data Working Group as directed by the Technology Standards Policy and Planning Committee.

This document represents a common viewpoint of those parties concerned with its provisions, namely transit operating/planning agencies, manufacturers, consultants, engineers, and general interest groups. The application of any recommended practices or guidelines contained herein is voluntary. APTA standards are mandatory to the extent incorporated by an applicable statute or regulation. In some cases, federal and/or state regulations govern portions of a transit system's operations. In cases where there is a conflict or contradiction between an applicable law or regulation and this document, consult with a legal adviser to determine which document takes precedence.

This is a new document.

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Introduction

This introduction is not part of APTA IT-RD-WP-001-25, "Open Data and Open Loop Payments Standards for Transit."

APTA recommends the use of this document by:

- individuals or organizations that operate rail transit systems;
- individuals or organizations that contract with others for the operation of rail transit systems; and
- individuals or organizations that influence how rail transit systems are operated (including but not limited to consultants, designers and contractors).

Scope and purpose

This white paper reviews existing documents related to open fare collection and open data and identifies data and revenue standards in use in the transit industry today.

Open Data and Open Loop Payments Standards for Transit

1. Background

Across the U.S., the transit industry is working to improve information delivery to customers by adopting open data practices and to reduce friction in fare payment through open-loop payments. In alignment with current trends, APTA created the Technology Standards Revenue and Data Working Group to identify best practices for open data, data integration standards, and transit agencies pursuing open loop fare payment systems. This working group's scope also encompasses the exchange of information in the form of data among transit business systems, subsystems, components and devices.

This white paper provides references to standards that currently exist for fare payment and data systems and opportunities to define these further within the transit industry. We conclude that sufficient standards exist to guide and regulate such systems while allowing sufficient flexibility for innovations as open-loop payments and open-data technologies continue to emerge.

1.1 Terms

As the technology landscape continues to evolve and change the mobility industry, it is important to define key components of open data and open-loop payments to understand the tangible impacts on public transportation.

1.1.1 Open data

Open data is a subset of all data and generally has the following characteristics:

1. It is available to the general public for free.
2. It is available for reuse and redistribution.

In the context of transit systems, open data should also be updated regularly or in real time. Public transportation provides open data as fare information, vehicle positions, and station and stop locations, among others.[1]

1.1.2 Data interoperability

Clear definitions and standards for open data are paramount in ensuring that different datasets can be combined, compared and used to draw meaningful insights. This interchangeability is called data interoperability. As transit systems require more complex services, interoperability becomes integral to allowing efficient communication and integration across diverse components. Essentially, interoperability enables transit operators to tap into richer information by allowing for multiple datasets to be combined.

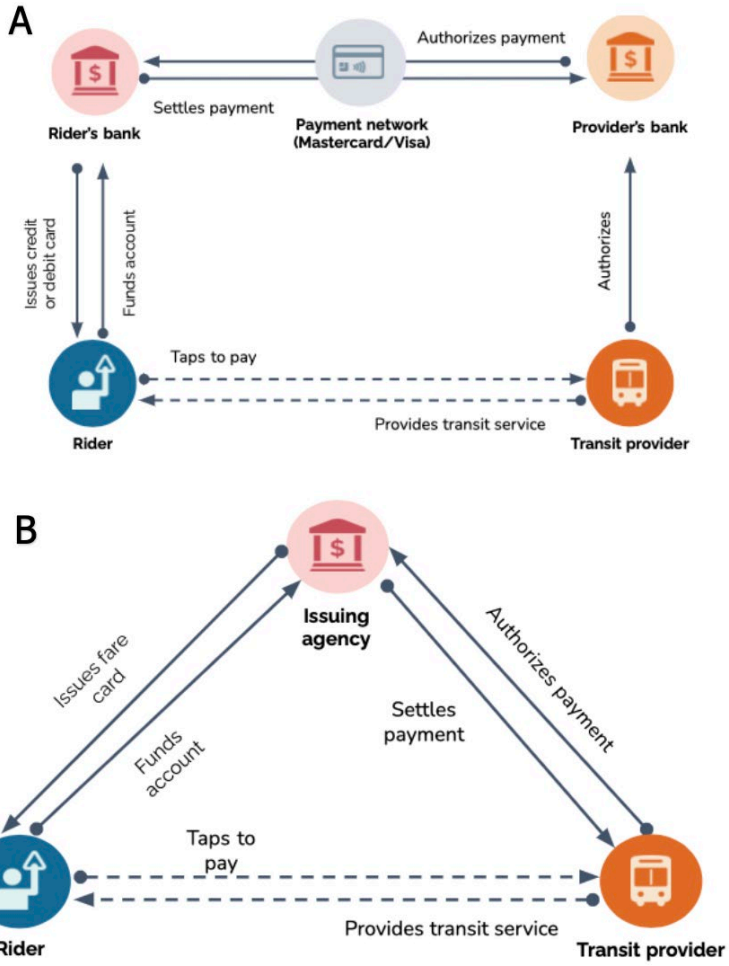
1. https://www.transit.dot.gov/sites/fta.dot.gov/files/FTA_Report_No._0095.pdf

As detailed in the Mobility Data Interoperability Principles, the goal of interoperability is "to foster a transit industry where mobility data flows freely and securely between systems, between operators, and between providers and the riding public, empowering transit agencies and other mobility service providers and transportation system managers to provide better service, improve the customer experience, and build systems that are equitable and sustainable."

1.1.3 Open loop payments

Open-loop payments refer to systems in which a customer can use any physical card or digital device to pay their fare, even if the card or device is not issued by the agency. This contrasts with "closed-loop" systems that require customers to pay their fares with an agency-issued card, ticket or token, as illustrated in **Figure 1**. In a recent study, 90% of Future of Urban Mobility Survey respondents in the U.S. expect more contactless, open-loop payment options.[2]

FIGURE 1
Open-Loop (A) and Closed-Loop (B) Payments Systems



2. https://usa.visa.com/content/dam/VCOM/blogs/visa-future-of-urban-mobility-one-pager.pdf

1.2 Applications of open data and open-loop payments

A modern transit system includes the components of open data and open-loop payments systems in the following places:

- **Physical structures or hardware components on vehicles.** These may include payment validators, computer-aided dispatch (CAD)/automated vehicle location (AVL) systems, GPS, or cellular or wireless routers.
- **Administrative affairs.** In this context, components most often relate to back-office software systems, including but not limited to scheduling software, General Transit Feed Specification (GTFS) schedules and GTFS Realtime publications.
- **Customer-facing components.** Appropriate, timely and accurate communications to riders regarding service alerts, trip planning details and fare information is essential to maintaining a healthy, satisfied ridership. Open loop payments and open data can provide new opportunities to interact with customers digitally but also should include intuitive interfaces in multiple formats, languages and communications methods to reach all riders.

2. Current transit industry standard organizations

In order to foster widespread use of open data and open loop payments in use today, the transit industry leverages global standards. There are at least six organizations that maintain a community of practice for existing standards related to open data and open loop payments:

- **Mobility Data (open data):** This nonprofit organization manages the GTFS (transit) and General Bikeshare Feed Specification (GBFS) (micro-mobility) trip planning standards. Mobility Data also develops open-source tools for stakeholders to validate that data conforms to the standards, as well as directories of data sources in those standards. https://mobilitydata.org/
- **ITxPT (open data):** This nonprofit organization develops, manages and/or endorses data standards for service provider coordination including onboard, back-office and over-the-air architecture. https://itxpt.org/
- **OpenStreetMap Foundation (open data):** This initiative develops the open street map Extensible Markup Language (XML) standard and maintains open street map data. https://wiki.osmfoundation.org/wiki/Main_Page
- **EMVCo (open-loop payments):** EMVCo enables card-based payments to work seamlessly and securely worldwide. This organization manages specifications, testing and product certification that ensure interoperability and acceptance of secure payment transactions. Specifications for individual technologies range from contact and contactless to mobile and QR code technologies, among others. https://www.emvco.com/
- **U.S. Payments Forum (open-loop payments):** With a focus on payments in the U.S., this group offers opportunities to advance the state of the practice through education, guidance and by considering alternatives. Working committees provide best practices for subjects beyond data and are particularly customer-oriented. For example, they provide guidance for customer-facing communications best practices. https://www.uspaymentsforum.org/

PCI Security Standards Council (open-loop payments): This organization sets standards and provides resources to help protect the people, processes, and technologies across the payment ecosystem to help secure payments worldwide. PCI Security Standards Council manages global payment security standards, validate and list products and solutions that meet the standards, and offering training, testing, and resources to security professionals and organizations. https://www.pcisecuritystandards.org/

- **International Organization for Standardization (ISO) (open data and open-loop payments):** This organization provides international standardization, particularly around banking and payments. It also guides open data practices for smart communities. https://www.iso.org/home.html

In addition, other organizations indicate support or have the potential to support the aforementioned standards.

- **Federal Transit Administration:** The FTA provides federal funds through grants for mobility projects. Participating projects must meet key standards, particularly supporting "improving American communities through public transportation." Most relevant to open-loop payments and open data are the Integrated Mobility Innovation projects (IMI). While projects must comply with a complete-trip vision, grant standards allow for maximum flexibility in meeting innovation goals. https://www.transit.dot.gov/
- **American Public Transportation Association:** The APTA Technology Standards Program was established to address and establish best practices for technologies that can be applied to multiple transportation modes and/or facilities. It also aims to address the many significant technological shifts and developments that have impacted transportation. These include significant developments in data, cybersecurity and platform-based transportation tools, among others that have changed the ways users and administrators think of transit and mobility. https://www.apta.com/

3. Foundational standards in use within the transit industry

Recent innovations in technology hardware, software and analytical tools, along with consumer expectations of digitization and modernization, are rapidly changing the technology landscape for mobility. Public transit systems are also able to leverage open data and open payments standards to improve services for customers. Two key standards are GTFS and Europay, MasterCard and Visa (EMV).

Regarding GTFS, Mobility Data provides operators with detailed standards. The extensive standard document for GTFS datasets outlines exactly what data is required, conditional or optional and includes best practices for end-user customer experience and data interoperability.

EMVCo sets the core standards for the ecosystem of open payments. These include Books 1-4, Common Payment Application and the EMV Card Personalization. The U.S. Payments Forums lists and describes relevant core standards from EMVCo and ISO in a report[3] on mobile and contactless payments standards, as well as materials and papers for transit contactless payments systems.[4]

4. Data interoperability

Mobility Data Interoperability Principles (MDIPs) are an example of an industry consortium developing a new approach to ensure system integration and interconnectedness. Released in October 2021 after a collaborative public process, the principles create an industry-agreed upon vision, definition and direction for achieving interoperability with clear roles and responsibilities. The principles are the following:

1. All systems creating, modifying or consuming mobility data should be interoperable.
2. Interoperability should be achieved through the development, adoption and widespread implementation of open standards that support the efficient exchange and portability of mobility data.

3. https://www.uspaymentsforum.org/wp-content/uploads/2019/11/Mobile-Payments-Standards-Glossary-FINAL-Nov-2019.pdf
4. https://www.uspaymentsforum.org/wp-content/uploads/2017/09/Transit-Use-Case-Technical-Solution-V2-FINAL-Sept-2018-1.pdf

3. Transit agencies and other mobility service providers should have access to tools that present high-quality mobility data accessibly, equitably and in real time to assist travelers in meeting their mobility needs.
4. Transit agencies, other mobility service providers and travelers should be able to select the transportation technology components that best meet their needs.
5. All individuals and the public should be empowered through high-quality, well-distributed mobility data to find, access and utilize high-quality mobility options that meet their needs as they see fit, while maintaining their privacy.

In practice, interoperability requires hardware and software considerations. ITxPT provides comprehensive standards on three levels of interoperability: hardware (installation, space, etc.), communication, and service. Standards exist for the following topics:

- **Installation requirements:** Refers to onboard Internet Protocol (IP) networks, connectors, interfaces, power supply network, and the vehicle communication for public transport vehicles.
- **Onboard architecture:** Includes modules and services that enable data to be shared IP networks, service discovery protocols, data exchange protocols, etc.
- **Back-office architecture:** Provides guidance on structuring data as it travels to and between back-office networks (networks that are not aboard vehicles) or is stored on back-office networks. Integrates both European and U.S. standards.
- **Over-the-air architecture:** Refers to communication protocols and data models that allow interoperability between vehicles, back offices, central IT systems and beyond.

5. Recommendations

As open loop payments and open data technologies continue to emerge, it is important for the transit industry to engage in the development and refinement of these standards to ensure that they support the goals of transit. Regarding open data and open-loop payments, at this time there appear to be sufficient foundational standards to guide such innovations. In fact, the Mobility as a Service (MaaS) Alliance came to the same conclusion, recommending engaging with existing standards[5] rather than creating new standards for interoperability, revenue collection and data.

To continue to be a voice for the transit industry in these various standards organizations, we propose that the transit industry consider the following recommendations:

1. APTA may provide guidance in defining key components specific to transit, creating consistency in use of standards across systems.
2. APTA should continue to support education programs to inform agencies about the existence of such standards.
3. The transit industry may foster cross-industry discussions to ensure that standards are relevant and that non-transit infrastructure may facilitate standards compliance for future projects.
4. The transit industry should support a focus on consistent interfaces across service providers.
5. The transit industry should support standards on the handling of data to ensure that all data and documents containing sensitive Personal Protected Information (PPI) is secured

Given the current standards and future monitoring, open data and open-loop payments systems are well-equipped to usher streamlined, interoperable transit systems in the U.S.

5. https://maas-alliance.eu/wp-content/uploads/2021/11/20211120-Def-Version-Interoperaability-for-Mobility.-Data-Models-and-API-_-FINAL.pdf

References

General Transit Feed Specification Best Practices. https://gtfs.org/schedule/best-practices/

Mobility Data Interoperability Principles (MDIP). https://www.interoperablemobility.org/

Definitions

best practices: A standard or set of guidelines known to produce preferred outcomes if followed. Best practices describe how to carry out a task to achieve optimal positive results.

closed-loop payments: Proprietary payments model where payments are limited to the media specific to the issuing retailer or provider. In a closed-loop payment model, the card issuer and the payment processor are the same. Though American Express and Discover are widely available, they are considered closed-loop payments systems since a bank cannot issue an American Express or Discover card. Similarly, the legacy smart card transit fare payment systems are closed loop because the transit agency both issues and accepts the cards and funds cannot be used anywhere else.

contactless EMV (cEMV): Europay, Mastercard and Visa media with chip technology within the card that does not require contact other than a light tap to process a payment. Though the acronym specifically calls out Mastercard and Visa, other brands such as Discover and American Express also rely on this chip technology.

data integration: The process of combining data from various source systems in order to perform analysis across multiple data sets.

data interoperability: The ability of systems and services that create, exchange and consume data to have clear, shared expectations for the contents, context and meaning of that data.

dataset: A collection of related, discrete information accessed individually, in combination, or managed as a whole. A dataset is information organized in a type of data structure.

fare collection: The systems by which public transit operators collect fares from the traveling public in exchange for riding a public transit service.

open data: As a subset of all data, open data is available to the general public for free and is available for reuse and redistribution.

open-loop payments: Nonproprietary payment model where payments can be made across all types of merchants, regardless of where the customer has an account. In an open-loop payment model, the card issuer does not necessarily need to be the payment processor. For example, credit cards, debit cards, and mobile wallets issued by financial organizations such as Visa, MasterCard, Apple, and so forth can be accepted at many retailers and providers.

standard: A repeatable and documented way of doing something that has been agreed upon by reputable professionals.

transit payments: Forms of fare collection media accepted by transit agencies, such as cash, tokens, cards with a magnetic stripe, contactless cards and QR codes (matrixed barcodes).

Abbreviations and acronyms

AVL	automatic vehicle locator
CAD	computer-aided dispatch
GBFS	General Bikeshare Feed Specification
GPS	Global Positioning System
GTFS	General Transit Feed Specification
GTFS-RT	General Transit Feed Specification – Real Time
EMV	Europay, Mastercard, Visa
ISO	International Organization for Standardization
IP	Internet Protocol
ITxPT	Information Technology for Public Transport
MaaS	Mobility as a Service
MDIP	Mobility Data Interoperability Principles
MDS	Mobility Data Specification
XML	Extensible Markup Language

Document history

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