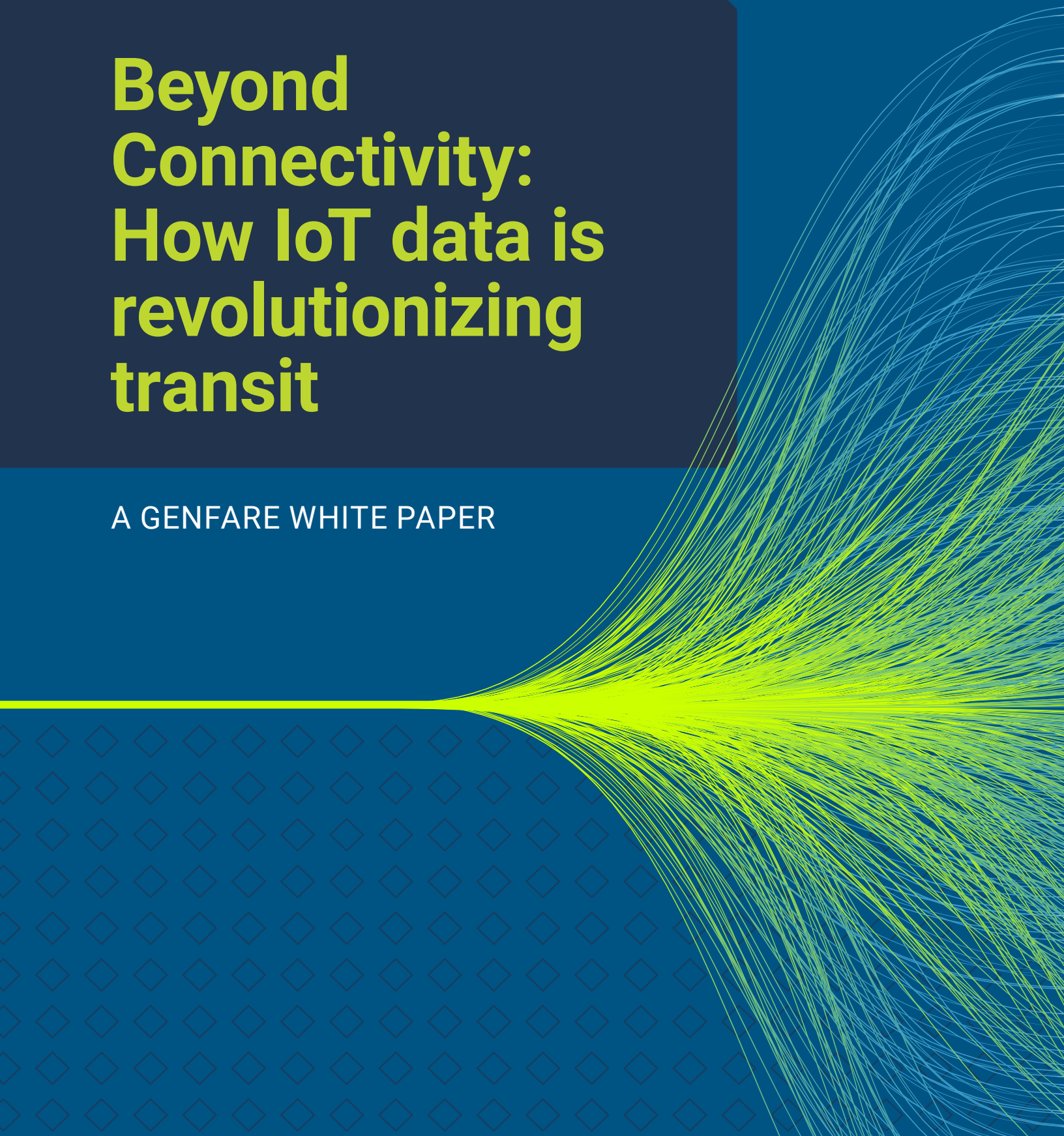# GENFARE

Beyond Connectivity: How IoT data is revolutionizing transit

A GENFARE WHITE PAPER

Preface

Information is as valuable as revenue to the health of public transit systems and the communities they serve. With improved access to advanced technology and an increasing willingness to embrace it, the American Public Transit Association (APTA) states that agencies are now positioned to make better, more efficient use of the large amounts of data they generate during everyday operations.

75% of transit agencies say their most frequently-used sources of data come from the bus.
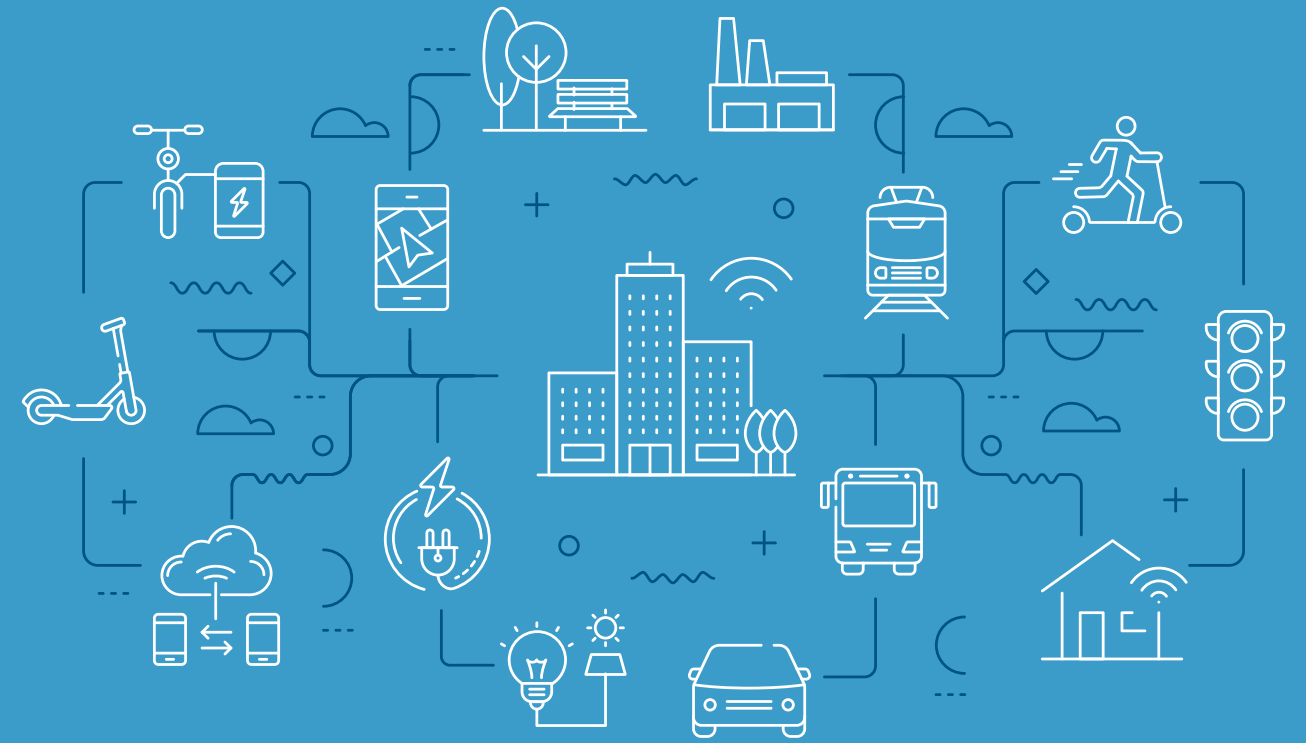APTA

More than 75 percent of agencies say that fareboxes, alongside automatic vehicle location (AVL) systems and passenger counters, are their most frequently used sources of data, according to an APTA survey conducted in 2018. Other technologies, such as digital payment solutions, generate valuable information as well, the survey found.

Yet, siloed data can be complicated and time-consuming to gather, interpret, and report, creating problems for agencies. For example, when data from various forms of fare payment such as digital, credit, and cash are difficult to reconcile, cash flow issues can ensue. And opportunities for fare adjustments and route and rider service optimization can be lost without the ability to conduct ongoing analysis of automated fare collection and other ridership data.

Fortunately, possibilities for efficient, cost-saving data collection, reporting, and analysis in public transit have exploded in the last decade, in large part thanks to improvements in technology that support the Internet of Things (IoT).

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Introduction: How the Internet of Things powers data-driven decision-making

The IoT refers to the collective network of connected devices and the technology that makes communication between devices and the cloud – or between devices themselves – possible. With IoT-enabled capabilities, every aspect of a transit system and every user can be connected by compatible hardware and software.

With the help of Application Programming Interfaces (APIs), the IoT enables the capabilities needed to integrate across platforms so that agencies can not only collect information more easily, but aggregate all that data in one location.

Genfare Link®, for example, is a cloud-based fare collection system that uses the IoT and APIs to consolidate data into a single source that is valuable across an agency. This can impact interoperability and flexible fare structures, organizational partnerships, maintenance and asset management, security, and perhaps most importantly, reporting.

Reporting allows agencies to collect and use data in a more responsive way. Easier access to data allows staff to deeply understand rider behaviors, preferences, and needs; make informed decisions and form strategies; identify risks and opportunities; and measure progress toward their goals.

For example, deeper dives into detailed data sets and the trends they identify can keep agencies on top of rapidly-changing neighborhood demographics and transit use patterns. With an analysis in hand, they can make better-informed decisions on route or timetable changes, fare discount and vehicle service options, and community collaborations that bring riders on board and keep organizational partners engaged.

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IoT benefits at a glance

The Internet of Things (IoT) is commonly used across workplace and residential applications such as video doorbells, smart thermostats, and tracking tiles.

In public transit, IoT helps to connect smart devices such as fareboxes, ticket vending machines, validators, and software to each other and to the internet. The resulting data can be accessed through a mobile application or a website.

There are many ways IoT-enabled technologies support public transit agencies, including:

- Distributed and controlled access to cloud-based data across users and devices

- Identification of new opportunities such as targeted fare structures for students or seniors or organizational partnerships with institutions and employers

- Predictive maintenance rather than reactive or preventive maintenance

- Monitoring of infrastructure and asset tracking for safety, security, and efficiency

- Enhancement of security with built-in features like end-to-end encryption, secure device identity, and access control to ensure data protection, comply with industry standards, and reduce vulnerability to threats

- Remote installation of software updates, fare structures, and security patches

- Future-proofing to embrace new technologies without disrupting the current systems

- Route optimization recommendations based on data over time to replace expensive and time consuming route studies
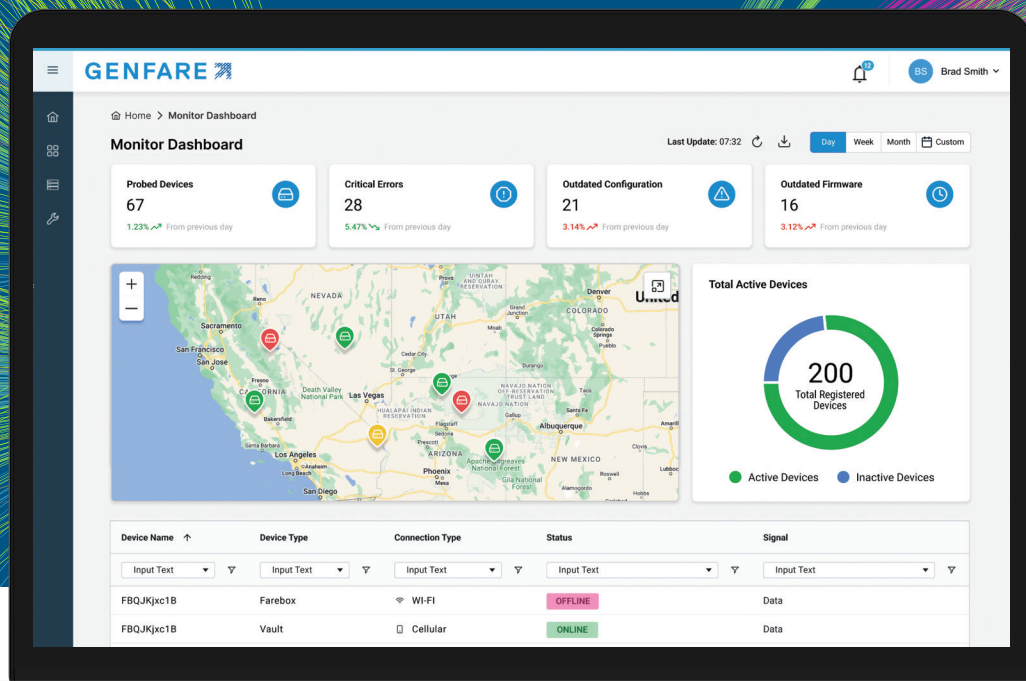
Embracing connectivity

The technology that enables the Internet of Things has been around since the 90s, but until the last decade or so, the chips used for it were too bulky, slow, and expensive for widespread use. Today, the IoT is everywhere and used every day -- at home, at work, and in public.

At the same time, transit agency leaders are becoming more comfortable with the idea of integrated technology and how it facilitates data gathering. In fact, six in 10 public transportation leaders say they are investing or planning to invest in the Internet of Things, artificial intelligence, and other technologies, along with emerging asset classes, according to a global survey commissioned by professional consulting firm KPMG in 2022. The intent is to "enable seamless services, deliver safe travel, and reduce customer costs," the company reports.

"Automation, AI, and IoT integration across the public transport network is also enabling the timely collection of huge amounts of passenger data," KPMG states in its report. Among the transportation organizations it surveyed, 27 percent agreed that "access to real-time data about service performance, location, and occupancy is the technology-related factor with the greatest potential to change the transport landscape."

"Today's world is run on information, and as an industry, we need to get on board with this," says Mike Loeffler, chief revenue officer at Genfare. "When it comes to using data to make decisions that impact operations, cost savings, or route analysis, agencies are still behind the times compared to other data-driven industries," he says.

Mike Loeffler
Chief Revenue Officer

"The technology we need to shift to data-driven transit planning is readily available, and in many cases, data is already starting to be collected," he adds.

In addition, equitable transit service that helps communities thrive depends on a deep understanding of riders' behavior and needs, says Sara Edney, product manager at Genfare. "To do so, it is essential to prioritize data-driven decision making by embracing the technological changes that are already here," she adds.

For example, IoT networks have allowed the three major transit providers that serve Chicago and its collar counties to centralize fare payments in an open-loop system using contactless fare payment technology. Riders of Pace Suburban Bus, the Chicago Transit Authority and the Metra commuter train system can use the same Ventra card, mobile app, or contactless bank card to pay their fares across all three systems.

This Ventra fare payment integration has resulted in greater equity and convenience for riders and a treasure trove of useful data, according to the U.S. Dept. of Transportation's Intelligent Transportation Systems Joint Program Office.

"In addition to increasing riders' access to local transit systems and thus potentially boosting ridership, the upgrade to the Ventra system allowed the agency [CTA] to generate rider data to better understand its customer base and tailor its services accordingly," the DOT stated in a 2021 briefing.

6 in 10 transit leaders have invested or plan to invest in advanced data technologies.

Real-time data exchange

The cornerstone of IoT is the real-time exchange of data. This typically involves three components:

Smart devices

These devices have computing abilities and can collect data and communicate it over the internet to and from its IoT application. In the case of transit, smart hardware includes fareboxes, ticket vending machines, validators, and other devices.

With open payment, customers will no longer need to use dedicated fare media, so not only will you need to buy fewer cards, but your workers can also spend less administrative staff time distributing cards and performing customer service functions.
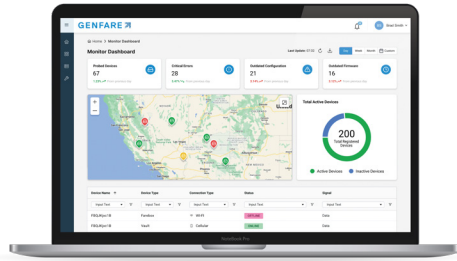
Application

An IoT application is a collection of services and software that collects and uses data from the smart devices in its system. A transit agency's fare collection software platform performs this function. IoT applications are growing more sophisticated, not just integrating data, but also using machine learning or artificial intelligence to respond to the data.

User interface

The graphical user interface is the part of the system that users interact with on a computer, tablet, or smartphone. This is typically a mobile application or a website. Examples of rider-facing user interfaces are Mobile Link and e-Fare.

No more waiting for a cloudy day

IoT capabilities are also supported by Application Programming Interfaces (APIs) and cloud-based computing services such as Amazon Web Services (AWS). An API is, simply put, language in software that allows software and smart hardware to communicate within and across platforms. In addition, cloud-based computer services such as AWS and their features are essential to data aggregation.

Cloud-based services are playing a greater role in helping agencies save costs when breaking down continuous sets of data, APTA reports in its 2019 policy brief. The organization found that 39 percent of transit agency respondents in 2018 had data programs that used cloud computing services. That number is much larger today.

"Cloud computing permits the sharing of data across an entire organization, allowing convenient access for different departments," the brief explains. "Software built into AWS can help agencies perform predictive modeling using large datasets."

Genfare Link® is one example of a cloud-based, one-stop fare collection platform that serves as both application (performing the functions you don't see) and user interface (performing the functions you do see). It is built on open APIs that allow agencies to import data from third parties and export that data to other systems. Using AWS, it functions as a centralized back office, with features including dynamic reporting dashboards that put data and analysis at the user's fingertips.

The Genfare Link platform is also modular and scalable, flexing as technology evolves and new ways to pay are introduced.

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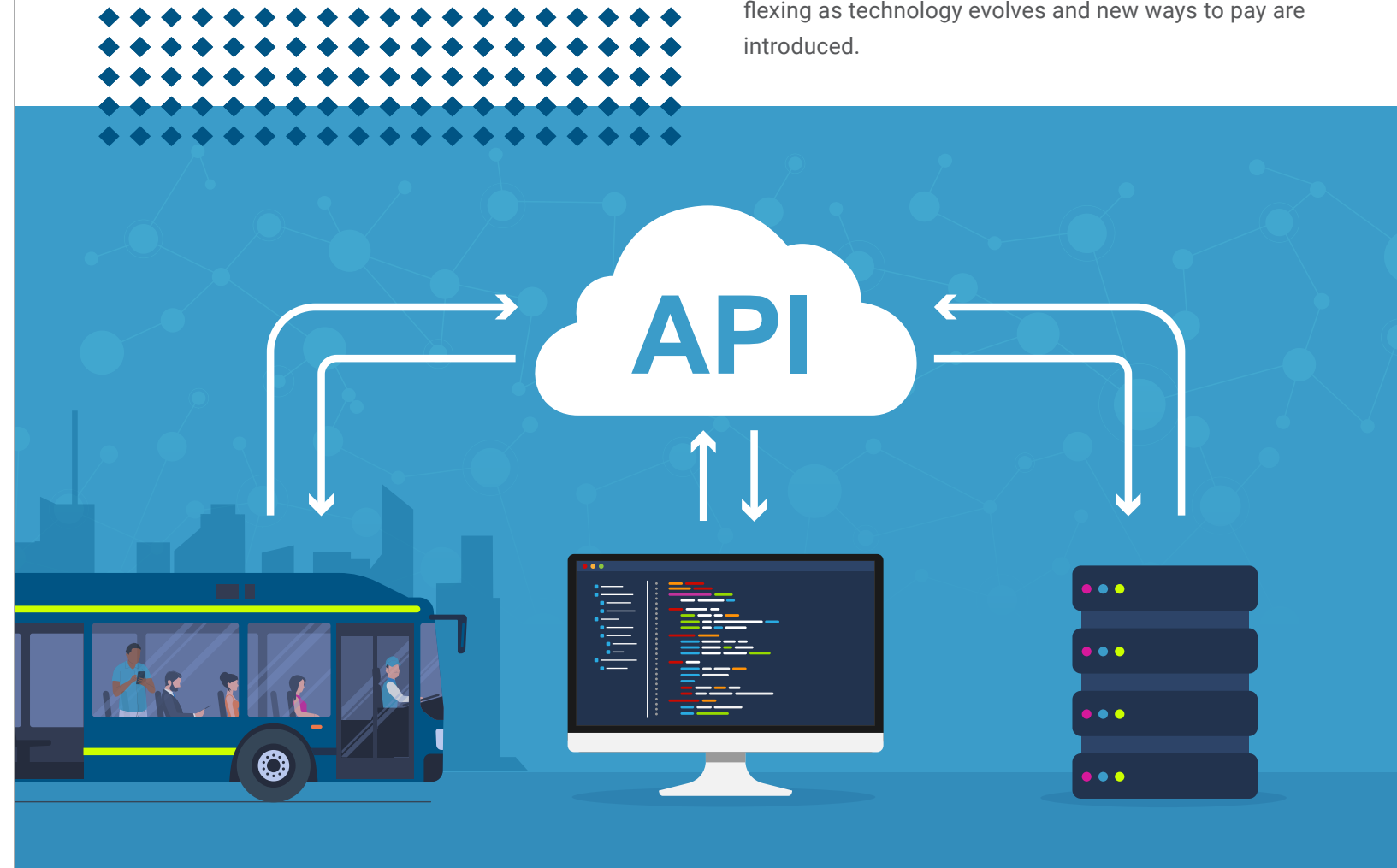
APIs speak your language

Application Programming Interfaces (APIs) are key to breaking down technological barriers so agencies can easily link platforms to each other and to end users such as riders.

An API is language in software that allows software and smart hardware to communicate within and across platforms. A familiar function of APIs is integration, which automatically updates data across systems. For example, when a rider pays their fare using an agency's mobile application at the farebox, that transaction is quickly reflected in Genfare Link's data feed and the rider's account interface. This works whether the agency uses Genfare's Mobile Link application or another company's, thanks to APIs.

APIs are also essential to maintaining the mountains of data generated by the different fare payment types used by transit systems, says Eric Kaled, president of Genfare. Reliance on one digital solution for mobile app payments, but not for cash or credit payments, for example, can make reconciliation very complicated, requiring an agency to log into and out of multiple systems to gather data, he explains.

In essence, the role of the API is to provide a set of definitions and protocols that help the client (the application sending the request) and the server (the application responding to the request) talk to each other. Documentation on the APIs tells software developers how to structure those requests and responses.

There are multiple ways APIs can be built (e.g., SOAP, RPC, Websocket, and REST), and multiple levels of access to APIs (e.g., private, public, partner, and composite). Regardless of the specifics, APIs have the potential to speed innovation by:

- Integrating new technologies with existing technologies
- Reducing the amount of code that needs to be written for new technologies
- Expanding access to data across systems and devices
- Allowing one system to change without impacting connected systems by acting as a gateway between the systems

APIs are not one-size-fits-all solutions. Time and care must be taken to build APIs that support the platforms that connect an agency's IoT-enabled solutions, says Kaled. But they are essential in an age when public transit agencies are digitizing fare collection to optimize and future-proof their services, he says.

Better data means better reporting

Every aspect of transit operations and administration can be enhanced by the Internet of Things, including reporting. A cloud-based reporting platform like Genfare Link gathers, integrates, and organizes data from across devices and systems and gives transit agencies clear insights into their system. It enables staff to access this data and customize and automate reporting, reducing time and effort and centralizing operations to remove silos.

When data is continuously transmitted from everywhere it is collected, centralized reporting from all points of contact can be used to give agencies a better sense of their riders. This includes:

- Who is riding which routes
- Where riders board, at what times, and how often
- How riders react to weather, events, and other variables
- How and where riders purchase their fares
- The impact of fare structure changes

This detailed data, delivered using intuitive analytical and data visualization tools, enables agencies to make informed decisions about responsive solutions.

"We should all be slicing and dicing this data to inform route, schedule, and fare planning so we can better serve our communities," Loeffler says. "This data can be used not just to plan where your buses are going and when, but what forms of payment you are accepting and where and how riders are purchasing fares."

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The Internet of Things

Beyond data gathering, here are some of the ways that IoT technology can enhance just about every aspect of transit operations and administration, including benefits that extend to every agency role:

Interoperability

Today's riders have more choices than ever for the first and last miles of their commute. Whether that's bike rental, scooter share, or park and ride, and no matter the provider, APIs allow riders to plan their trip or even pay for it across modalities. Imagine the convenience to a rider who can pre-pay for their parking, know exactly when the bus arrives, and check how many bikes are available near their bus stop on the same app they use to purchase fares.

Interoperability also applies to neighboring or overlapping transit systems. For example, Genfare customer Pace Suburban Bus shares a smart card system and trip planning data with the Chicago Transit Authority and the Metra commuter rail system, even though all three systems have different fare collection hardware and software.

Flexible fare structures

APIs make it easy to push new fare structures to fareboxes and validators; enable fare capping using smart cards, open payment, or mobile apps; and even offer short-term promotions such as free rides or round-trip discounts on specific routes for events. Riders and operators don't even have to think about the fares because flexible structures are easy to implement across payment methods.

Organizational partnerships

The IoT simplifies partnerships between organizations and transit agencies. This allows the schools, employers, social service agencies, or healthcare providers to not just manage fare payment for riders associated with their organizations, but also to get creative about fare payment. Or a hospital could provide discharged patients with a printed barcode good for limited rides originating near the facility, and the farebox will have the information it needs to validate the fare by the time the rider boards.

Dispatch and tracking

Computer aided dispatch (CAD) provides communication between bus operators and dispatch and automatic vehicle location (AVL) tracks the locations of vehicles. The CAD/AVL system can be connected with systems such as trip planning apps, public-facing websites, municipality construction and emergency closure databases, and fare collection solutions. That leads to real-time communication and robust data integration, providing valuable real-time and aggregated information to riders and administrators alike.

Maintenance and asset management

The Internet of Things can monitor hardware to identify potential problems and troubleshoot – often before anyone realizes there's an issue. Alerts can be set to let garage staff know when a farebox needs to be vaulted, a printer head or belt is nearing replacement, or a component isn't working before the bus returns to the depot. It can also track events that may indicate a maintenance or operator training issue, such as excessive overrides or bypasses, then troubleshoot accordingly and notify the appropriate staff.

Genfare Link: A single source of truth

Genfare Link is a cloud-based, one-stop fare collection platform that simplifies fare collection management while empowering data-driven decision-making. Open architecture allows Genfare Link to integrate with any smart hardware or third-party software to aggregate all data in one location, with accurate data across all fare collection equipment

This consolidation of data into a single source of truth is valuable across an agency, empowering staff to deeply understand rider behaviors, preferences, and needs; make informed decisions and form strategies; identify risks and opportunities; and measure progress toward goals.

As a centralized back office with dynamic reporting dashboards, Genfare Link features allow various users across multiple roles to look at the big picture or drill down to granular data. Reporting feeds data from all devices to ridership, cash reconciliation, revenue, sales, and maintenance dashboards to create both quick and custom reports.

When there is a request for data, Genfare Link streamlines processes to reduce inefficiencies and optimize resources, cutting time spent creating reports and solving problems.

Genfare Link is a fare collection platform that is affordable, accessible, reliable, and quick to implement from the company known for empowering equitable mobility for more than four decades.

Download the Genfare Link brochure

Conclusion

IoT technology can help gather, store and use data more quickly and efficiently, empowering dynamic environments where data-driven decision making helps agencies adapt more quickly to changes in the community, technology, or regulatory landscape. With big-picture and granular data, plus reports and analyses in hand, agencies can better design forward-thinking initiatives ranging from route optimization to ridership outreach to community partnerships.

"The solutions that can help with data collection and monitoring to make these data-first decisions are available today and are likely compatible with the technology transit agencies already have in place," says Sara Edney, of Genfare. "When on-site technology is able to do the data gathering, put it all in one place, and aid agencies in efficient analysis and reporting, that's powerful," she adds.

"We believe agencies are now on the cusp of collecting and using data in a more responsive way that better serves all potential riders."

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Partner with Genfare

Selecting the right partner to help make your plan a reality is key to ensuring its success. Contact us today to learn how an enhanced fare collection solution can elevate equitable mobility at your agency.

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