



Innovation in public transit

How agencies are accelerating modernization with the cloud

During the pandemic, transit systems have been vital for ensuring frontline and essential workers can safely get to work and continue to serve the public. These systems, which include buses, subways, and trains, have shepherded the elderly, disabled, and other vulnerable populations to grocery stores and doctor's offices. In normal times, they help reduce congestion, get students to school on time, and provide a safe mode of transportation for millions of people.

But the COVID-19 pandemic has created a fiscal crisis for transit agencies, and in some ways, a crisis of public confidence as people are concerned about exposure to the virus while using public transit. Transit departments were underfunded prior to the pandemic, and many agencies have had to enact service cuts to maintain operations over the last year. Even with nearly \$70 billion in stimulus funding, agencies will face a more than \$9 billion projected shortfall over the next two years.¹

For most transit agencies, maintenance of service and infrastructure has taken priority over advancing

innovation² — although more municipalities are gradually embracing initiatives like Vision Zero,³ shared bike services, pedestrian-friendly slow streets, and other smart mobility solutions. As the pandemic subsides, transit agencies will need to continue to innovate to effectively address issues such as congestion, health and safety, and equitable service.

Leveraging the cloud can help them maximize the data they collect to achieve these goals. Some transit agencies already have adopted the cloud and advanced data management platforms to improve their operations. The Maryland Transit Administration (MTA) is one of them. The agency has worked with two companies — [Swiftly](#) and [Remix](#) — that have built their solutions on [Amazon Web Services \(AWS\)](#) to modernize its transit networks.

Due to funding or staffing constraints, many transit agencies have fallen behind on using innovative technology. But MTA has embraced technology modernization in recent years, which helped it be more responsive and nimble during the pandemic and build its resilience for the long term.

Navigating today's transit challenges

In 2020, transit ridership levels decreased by 79 percent nationally compared to 2019. At the same time, agencies have had to adjust their operations, schedules, and service routes amid changing capacity requirements, while also facing increased health and safety-related costs for personal protective equipment and sanitation services. According to the State of Public Transit Survey, conducted by Swiftly, 22 percent of transit professionals didn't have enough budget resources for their COVID response, and 81 percent say budget is their top concern this year.⁴

MTA has faced many of these challenges as ridership levels declined by 60 percent.⁵ Michael Helta, MTA's chief innovation officer, says the agency's vision is to provide safe, efficient, and reliable transit across Maryland and world-class customer service. However, the pandemic has given new meaning to this mission.

"With COVID, some new things have come about. Safety from a cleanliness and social distancing perspective is becoming a much bigger priority," he says. "We're figuring out how to make the ride as safe as possible and give our riders the best possible experience."

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Michael Helta, Chief Innovation Officer, Maryland Transit Administration

Helta says capitalizing on the agency's transit data is a cornerstone of this effort.

"One of our current focuses is how we use all the information we have throughout our various databases to drive change," he says.

MTA has historically grappled with data silos because of disparate, proprietary systems that lacked interoperability. But the organization's collaboration with Swiftly and Remix — and the technology investments it has made over the last three years — has helped it transform into a more



data-driven organization, improve service delivery, and be better prepared for the massive disruptions caused by the pandemic.

Swiftly is the leading big data platform that helps transit agencies and cities improve their operational efficiency, make smarter infrastructure investments, and better engage their riders. The platform weaves data analytics, intuitive visualizations, and real-time predictive technologies into applications that drive mission-critical functionality for smart transit. The platform touches more than 1.5 billion passenger trips and processes over 1.3 billion API calls per year. Remix is one of the leading transit planning platforms. More than 350 cities worldwide use Remix's transit planning software to forecast the potential impact of service and schedule changes, ensure they deliver equitable service, meet the mobility needs of vulnerable populations, foster greater inter-agency collaboration, and most recently, to increase their business agility around pandemic service planning. For example, agencies can use Remix's customizable demographic analyses and route drawing tools to implement quick service changes and gather insights on specific points of interest on different routes, including essential service establishments such as hospitals, grocery stores, and testing centers.⁶

Swiftly and Remix have established a partnership that allows agencies to access data produced by Swiftly, such as historical speed and dwell time data, within Remix's planning software. Together with Remix's historical ridership

data and passenger load data and frequency and cost tradeoff analyses, agencies can make more informed transit decisions about things such as where to install emergency bus lanes, what capital improvements and transit projects to prioritize, and where to install transit signals. They can also quickly assess the impact of any transit changes.

The ability to harness this data in real time wouldn't be possible without a flexible, scalable cloud infrastructure, which is why Swiftly and Remix have leveraged AWS solutions and services to empower transit agencies to modernize their operations.

Paving the way for innovation with the cloud

Both Remix and Swiftly run their applications on AWS Cloud infrastructure. The companies also use a range of AWS Cloud services to cost-effectively and securely store the gigabytes and terabytes of transit data they collect and flexibly scale their compute resources.

"A lot of our customers [transit agencies] used to plan using paper and pen. They actually had hard copies of things, such as an Excel spreadsheet that lived on someone's computer or one license to an on-premises software solution," says Courtney Sung, head of strategy and business development for Remix. "As you can imagine that type of situation or set up makes it really difficult to move quickly and collaboratively."

As a cloud-native company, Remix solves this problem. Its platform can ingest a variety of data sets that help agencies gather insights in real time for better decision-making.

"Our high-volume data sets are scooter and bike share data. We ingest census data that has information about low-income communities and where people are traveling for work. We also ingest and upload data that cities provide us directly, such as population forecasts. We've recently brought in a lot of essential services information for COVID planning, and we're able to drive insights very quickly by using AWS Cloud infrastructure," Sung says.

Jonathan Simkin, CEO and co-founder of Swiftly, echoes the same point about the computing power AWS provides.

"We process, in order of magnitude, hundreds of terabytes of data from agencies of all sizes around the world. Most of our real-time processing happens in milliseconds, and most of our historical data analyses, where we're looking at tens of millions of data points for certain queries, typically takes hundreds of milliseconds to seconds," Simkin says.

“We looked at other cloud providers, but we felt AWS was the best choice for all of our data partners. AWS gives us more time where our data scientists can be looking at transit data and building algorithms to better predict arrival times for riders. We don't have to worry about the infrastructure or servers.”

Jonathan Simkin, CEO and Co-founder, Swiftly

Using AWS's powerful cloud services enables Remix and Swiftly to bring more innovation to their customers because they can focus less on custom coding and instead leverage AWS's built-in capabilities to ensure maximum performance, reliability, and scalability for agencies that use their solutions to access and redeploy transit data across their operations.

"It's really the standard for cloud development. We looked at other cloud providers, but we felt AWS was the best choice for all of our partners," Simkin says. "AWS gives us more time where our data scientists can be looking at transit data and building algorithms to better predict arrival times for riders. We don't have to worry about the infrastructure or servers."

MTA has used Remix and Swiftly solutions to innovate in several ways.

Helta, who has worked for MTA for over a decade, says the agency traditionally hadn't used data "nearly to the level that we do today." Agency leaders decided to leverage cloud solutions like Remix and Swiftly because of the massive computational power the cloud provides.

"We're able to get an answer to and highlight problems much quicker now, simply because the data is computed at a much faster pace," Helta says.

Helta says MTA can now access real-time information on vehicle operations. In the past, the agency only knew where 60 to 70 percent of its buses were at a given time and only received updates every two to four minutes about their location.

"That wasn't really good enough to real-time manage the system. It also didn't give us complete data on the back end for analysis," Helta says, "Swiftly came in and they had a solution that allowed us to very quickly have information for all our buses."

Swiftly also has fostered more inter-agency collaboration. MTA now uses its dashboard in meetings and across multiple departments, including maintenance, operations control, schedule development, and performance management. MTA also uses Swiftly's application programming interface (API) to access raw data that helps the agency build custom internal platforms for deeper data analysis. With all these capabilities, MTA improved its on-time performance by 10 to 15 percentage points before the pandemic. Swiftly's runtime adjustment tool — which looks at the amount of time a bus takes to complete its trip on a stop-by-stop basis — has also helped MTA be more agile and make service changes more quickly, which helps improve on-time performance and the frequency of service for riders at certain stops.

"We leverage that tool to make 10 times more adjustments to our schedule than we were able to do in the past," Helta says. "It's driven the ability for us to conduct in-depth performance monitoring and targeting to improve customer service."

MTA also has used Remix to improve network and route design for its bus service. The agency relied on the transit planning tool for its BaltimoreLink project, in which it redesigned its entire bus network. Remix helped the agency make more informed planning decisions about route alignments (such as what street to put a bus route on) and allowed MTA to quickly analyze demographic and travel time estimations. This helped the agency ensure it redesigned its transit system in the most efficient way, especially in the most high-density corridors and in car-free communities that greatly rely on public transit.

MTA's experience with Remix during the BaltimoreLink project ultimately better prepared it for the changes it had to enact over the last year due to the pandemic. MTA currently uses Remix in its planning and service development departments to produce preliminary cost and resource estimates for proposed service changes; identify access impacts using the Jane feature; perform equity and other impact analyses with built-in data layers; and respond quickly to data requests from agency leadership, elected officials, and the community.

By leveraging the cloud, MTA is modernizing its operations, making its transit services more equitable, and positioning itself to better serve the public in good times and in bad.

Conclusion

As the country gradually recovers from the pandemic and embraces a new normal, transit agencies may have to make hard choices about how they bring back service and move forward.

Though federal funding will help them stave off the most severe service cuts, agencies still will have to adjust to combat revenue shortfalls, maintain adequate service levels, and deliver the modern, technology-enabled experience constituents deserve — whether it's providing real-time information on bus capacity or commuter train arrival times.

Cloud-based solutions can empower agencies to be more nimble; maximize all the transit data they collect; and improve the efficiency, reliability, and safety of public transit systems.

"Our long-range plan is to provide the best customer experience as possible and the best information to our riders, so they know what to expect. We want to build a service that is as reliable as possible and that utilizes our resources to their fullest extent," Helta says.

For more information about AWS, please **contact us**.

This piece was developed and written by the Government Technology Content Studio, with information and input from AWS.

Footnotes

1. <https://www.apta.com/wp-content/uploads/APTA-COVID-19-Funding-Impact-2021-01-27.pdf> (Note: The \$39.3 billion shortfall mentioned in the report does not include \$30.5 billion in funding from March's American Rescue Plan. Hence, the \$9 billion remaining shortfall).
2. <https://www.npr.org/2020/12/29/951208111/what-is-the-future-of-public-transit-in-the-u-s>
3. <https://visionzeronet.org/>
4. <https://f.hubspotusercontent30.net/hubfs/2336437/State%20of%20Public%20Transit%202021.pdf>
5. <https://www.mta.maryland.gov/articles/290>
6. <https://www.remix.com/blog/pandemic-service-planning-in-remix>

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