Transforming
Urban Mobility

Microsoft
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As populations continue to grow and the trend to city migration continues, the topic of transportation and urban mobility becomes one of the largest challenges faced by civic leaders to the sustainable economic growth of their urban centers.

Anyone living, working or visiting a city, or trying to get to school or work or to shop in the city or suburbs, is immediately confronted with the personal challenge of doing so using the fastest, safest, and most comfortable and affordable way possible. For many, the solution is to use a public mass transit systems and often a journey involves using more than one mode. This information challenge for citizens starts in understanding how to get from A to B, when, and at what fare. The plethora of passenger transportation apps is making this challenge less frustrating, driven by live streaming of GPS and sensor data providing the status of trains, buses or subways, together with route planning intelligence, alerts and personal account, pre-pay or contactless payments.

For the operators, the challenges are even more complex. They need to deliver punctual, highly utilized, cost efficient services, while maintaining fleets and infrastructure assets, managing personnel, payments, timetables, routes, incidents caused by emergencies or weather and a myriad of other interconnected factors. At the same time they are modernizing and transforming their older legacy systems in the face of rapidly advancing technologies and regulations.

Where the public transport system is too distant, unconnected or unreliable, many still choose to use their car or take a taxi or share a common journey with others using ride-share and car-pooling services. However, these journeys still share crowded roadways with increasing numbers of delivery and service vehicles as the ‘on-demand’ economy drives the growing volume of individual deliveries of goods, food and anything else we can order online. For these modes where the driver is the operator and the city or local government owns the roadways, it is navigation, traffic flows, parking, tolls and congestion that all need intelligent technology and often, integrated across multiple transport modes and operating companies.

In this eBook we will take a brief look at how these challenges are being approached by the agencies that are pioneering the use of urban mobility technologies to deliver increasingly positive impact on our experience of getting from A to B.
The technology revolution enabling the future of urban mobility

The complex information management challenges presented by the need for better urban mobility, have arrived at a point in time where the availability of cloud-based technologies, cited as the ‘Fourth Industrial Revolution’ is well placed to provide innovative solutions.

The availability of plentiful, low cost, scalable processing power and massive storage fuelled by torrents of GPS, IoT sensor data and combined with intelligent algorithms, machine learning and insightful analytics, provides opportunities to transform the way we travel, commute and move around our urban spaces.

It wasn’t so long ago that de-ciphering a printed timetable and paying in cash for a paper ticket, was the way citizens utilized public transport. The paper and magnetic stripe card ticket has given way to the contactless smart card that now performs the roles of payments and authority to travel linked to individual account records. Timetables benefit from analytics showing the optimal routes and utilization. Sensors enable real time situational awareness and vehicle status, and transport operators are managing the efficiency of fleets, infrastructure and drivers by better understanding the data they gather, modelling cost efficient and effective improvements. And with the predominance of smart and mobile devices, the citizens,
drivers, operators and field distributed staff that interact with mass transit systems are connected wherever they need to be and at any time.

When vehicle journeys are preferred or essential, cloud technologies are also driving benefits. Smart navigation is informed by real time sensor information on optimal routes, congestion and cost calculations, linked to available parking locations, while telematics and engine management sensors provide data on vehicle and driver performance. And all of these technologies, combined with lidar, radar, odometry and machine learning technologies are fuelling developments in autonomous vehicles. Traffic light sequences are adjusted to optimize flows in real-time based on road and weather data and changed to help emergency services get to incidents quickly. Tolls can use dynamic pricing to ease any building congestion taking inputs from license plates, stickers and on board RFID tag devices and can refer to historical patterns of road use to predict future changes.

All of these examples exploit the automated sensing, transmission, integration, processing and analysis of vast amounts of data in volumes unheard of before the availability of cloud computing technologies. This data, when managed wisely, can reset our experience and inform our choices of travel and modes of transport. At the same time, operators and governing authorities can better understand the performance of policy and services while indicating opportunities to optimize cost effectiveness, efficiency and new business models to improve urban mobility.

The following pages will review some key areas of urban mobility and how Microsoft and partners are helping citizens, operators and relevant agencies to harness the technology revolution that is transforming the mobility experience.
Fare and toll management

Public mass transit systems and toll controlled roadways are increasingly moving to account-based technologies.

This provides a fast and convenient way to pay for different travel options using credit or debit cards, smartphone or a smart contactless card that integrates payments and data provision for multiple agencies and travel modes. As with other citizen services, identity is a pre-requisite essential for managing access and payment to transit systems and for understanding traveller behaviour to enable better service delivery. Many operators are adopting smart card payment system or using smartphones and contactless bank payment cards resulting in convenient and cost-effective ways to pay for a choice of connected modes of public transport.

“Our experience of working with Microsoft has been very positive and it’s a strength we can build upon for future work as well.”

Transport for London (TfL) rethought their approach to fare payments to reduce the costs and inconvenience of paper magnetic stripe tickets on buses, trams, trains and the London Underground. Instead of cash, TfL passengers can choose to use the agency’s branded pay-as-you-go ‘Oyster’ card or contactless credit or debit cards using a new ‘touch-in, touch-out contactless system running on a cost-effective, powerful, reliable data platform from Microsoft and partner Cubic. Contactless fares are just one of the ways TfL are putting both big and small data to work to fuel innovation, unleash insights and empower better ways of working.
One way to reduce congestion, pollution and lost productivity is through a transformation to automated tolling technologies using number plate or sticker recognition or electronic RFID tags that provide identity and payment authority, while managing the toll rates to influence road use. These dynamic pricing strategies can be implemented based on time of day, demand, congestion, emissions, season, vehicle tax type and other relevant factors.

"Dynamics AX improved efficiency overall. We now use electronic approvals — no more walking documents around the office for signature."

**Georgia’s State Road and Tollway Authority** (SRTA) needed to implement three new toll roads and manage electronic toll collection while extending their scope to manage the Georgia Transportation Infrastructure Bank. SRTA saw the opportunity to be more agile to deal with multiple managed lane facilities as well as the necessary accounting and financing activities and required a scalable, trustworthy, familiar yet modern solution. To meet these growing needs, SRTA, with the help of Microsoft Partner, Crowe Howath, deployed Microsoft Dynamics technologies to manage multiple business and accounting processes, improving SRTA’s ability to manage their growing responsibilities.

Microsoft, together with a host of urban mobility partners, are working with agencies to enable integrated solutions covering all areas of operations from the fare and toll payments and accounting to analytics and business intelligence. With the technologies and expertise they need to analyse, plan and model their business with increased speed and accuracy, agencies can influence traveller behaviour by using dynamic pricing, offers and incentives across multiple travel modes.
Operating a safe, reliable consistently punctual public mass transit system can be a challenge as rider numbers grow and traveller expectations of service levels increase.

Agencies not only need to manage and maintain the fleets of vehicles, rails and roads, but also look after the stops, station buildings, maintenance centers and an increasing inventory of digital assets including signs, signals and sensors that deliver the vital data and information needed to operate and use a modern transit service.

Passenger safety is a primary consideration for all operators so maintenance procedures and schedules need to be managed and issues anticipated and predicted with the help of sensing data. Staff can be alerted when the symptoms of a problem are detected, from a noisy wheel bearing to a cracking road surface or a failing traffic signal to enable predictive maintenance that prevents the costs and downtime due to failing parts, helping prevent unsafe operations.

"Using Microsoft technologies, we have decreased fuel consumption by 5 percent, improved our drivers’ performance, and increased rider satisfaction by 7 percent."

Service performance and cost efficiency are also essential to delivering the service at a fare the citizen can afford while allowing ongoing investments for safety, infrastructure modernization and increasing capacity that contribute to a safe and viable future for the service. Operators need to monitor vehicle and driver performance to understand the optimal model for each fleet asset including fuel consumption, the most efficient routes through traffic and trip data collection, aggregation and visualization.
The city-owned bus system **Helsingin Bussiliikenne Oy** (HelB) competes with private bus operators for city routes in Helsinki, Finland, so it needs to stay cost efficient, safe and competitive. Working with Microsoft and partner CGI, HelB expanded the company’s data warehouse solution to collect and analyze data from bus sensors that generate more than 4 million lines of data each day, helping to reduce fuel consumption, improve driver performance, and make bus rides smoother and safer. Engine sensor data helps HelB to identify vehicles developing mechanical problems for preventative maintenance. HelB monitors bus driver performance, including speed and braking, and shares the data with drivers to improve driving safety and efficiency. This data-led approach has enabled overall fuel consumption reductions of 5 percent helping reduce the city’s carbon footprint and rider satisfaction is up by 7 percent.

"With the systems that Microsoft Services has created for us, we have improved the reliability of São Paulo public transportation by 30 percent."

**São Paulo Transporte S.A.** (SPTrans), in Brazil, operates 15,000 buses that drive more than 1.7 million miles each day over 79 miles of streets used exclusively by buses, with 17,000 stops and 28 transfer terminals across the metropolitan area. Of the city’s 11 million citizens, 7 million use the bus system daily, with 55 percent of intercity trips made on mass transit. Sao Paulo worked with Microsoft Services to enhance its electronic bus monitoring system to deliver status information to passengers via web and smartphones and as a result has increased bus service reliability by 30 percent.

Microsoft and its partners are using IoT, smart network planning and predictive maintenance technologies to deliver the advanced capabilities required by urban mobility operators. Fleets and infrastructure assets can be optimized to improve routing, scheduling and maintenance resulting in improved services to citizens, lowering operating costs and improving insights into essential data and information across the integrated transport system.
Traffic and transit management

The congestion, emissions and delays caused by traffic gridlock are a major issue for urban centers with the potential for reduced quality of life and increasing the costs and delivery times of goods and services.

Time lost in lengthy commutes wastes energy and the valuable time of citizens and businesses, negatively impacting an economy and lowering overall productivity. The digital transformation to cloud-based technologies can help resolve these challenges, improving the attractiveness of cities to inward investment and improve the quality of life for everyone living within or visiting the city.

“We spoke to a number of cloud technology companies, and Microsoft was the most engaged and able to offer the services we needed,”

When Cubic Transportation Systems, a leading international provider of intelligent transport solutions was developing a new traffic management solution for cities, they needed to deliver a scalable, centrally managed platform and the company knew it needed the cloud. Their customers were increasingly relying on sensors to manage transit traffic so any new solution needed to connect those sensors and also be consolidated onto a distributed platform. In addition, the majority of sensor information doesn’t need to be collected 24×7, so the solution had to scale up or down as needed. Cubic chose the Microsoft Azure cloud to create its new NextTraffic solution. The cloud would enable Big Data analytics and visualization across multiple transportation options and deliver a web-based common operating picture with security enhanced access by authorized employees from anywhere, including a tablet or mobile device.

Cloud technologies are helping modernize legacy traffic systems to deliver an integrated holistic view of a multi-modal traffic and transit environment. They are also providing the affordable flexibility and scalability needed to adapt to changing needs and manage peak traffic flows or special situations when computing resources are
in greatest demand. By bringing together multiple systems and data types, from internal and remote sensors and even real-time social media sentiment feeds, operational awareness is increased to new levels. Making traffic data available to citizens and developers increases transparency and can lead to new apps and innovations that improve the passenger experience. And with the addition of analytics and mixed reality technology, data can be analysed, enhanced and visualized in new ways for greater insight and understanding enabling operators to forecast future demands and innovate new and improved services and delivery models. In turn, this helps increase rider numbers and smooths the flow of traffic for all who share the same roads, rails and infrastructure.

Efficient urban mobility is a multi-factor challenge where cloud technologies are providing data-driven affordable solutions from bus route coverage to new ride-sharing entrants, to weather and incident issues, maintenance and new infrastructure construction. Microsoft and their transportation partners are delivering solutions for agencies and operators to connect systems more efficiently and optimize the citizen experience.
Parking management

In any urban center, a car, bus, truck, van or bike will need to stop and park. Finding a safe and secure parking place or space to load and unload is a problem shared by city drivers around the world.

Cities limited by budget constraints or just the sheer lack of space, struggle to cope with the increasing number of vehicles on the roads and streets. Meanwhile, drivers looking for parking can waste valuable time and fuel, increasing pollution and adversely affect the quality of city life.

The daunting prospect of finding and paying for ‘on or off street’ parking can be motivation enough for many to leave the car behind and use mass transit. Many cities have resorted to car free zones, pedestrianised streets, bus lanes, ‘park and ride’ and car-share schemes and other strategies to limit traffic and encourage all but the authorized, essential or permitted drivers from the crowded city centers and onto other transport modes.

The Autolib’ organization is an electric-car-sharing program established by the city of Paris and 63 surrounding municipalities with over 8 million people, to relieve traffic congestion, reduce noise and air pollution, and provide citizens with more flexible transit options. More than one million people drive in Paris each day, most commuting from the suburbs outside for work. Ten percent of traffic in Paris is due to people looking for a parking space. Autolib’, implemented by logistics company IER, relies on intelligent systems and a back-end infrastructure based on Microsoft technologies. The system connects 72 registration kiosks, 850 rental kiosks, more than 4,300 charging stations, and 2,300 in-car systems that help reduce carbon dioxide emissions by 75 metric tons and can cut a drivers’ transportation costs by 90 percent.
However, for many cities, where the car is still dominant, there is the need to optimize available parking facilities and fill capacity by providing information to drivers and direct them to a parking place with minimal delay and congestion. By promoting behavioural change strategies and adopting a broad platform of cloud, Big Data, mobile and social technologies, urban center leaders can get more value from their existing parking spaces and road infrastructure.

“Real-time data allows us to maximize the efficiency of our parking facilities to enhance the user experience when choosing to park in our city,”

The City of Sacramento in the USA is working with Microsoft partner, Amano McGann in testing the Symphony Analytics™ software-as-a-service solution and Microsoft cloud-based technologies to help citizens find a parking place and avoid traffic congestion. The new system aggregates and analyzes off and on-street parking data in real-time to help drivers find available spaces and the city to make informed decisions. The Microsoft Azure cloud platform provides the scalability and flexibility required for yield management and dynamic pricing techniques that change parking prices at different times of day, using similar demand-based models to airlines and hotels, to fill spare capacity.

Cloud-based technologies from Microsoft and its partners are enabling a range of solutions to increase the efficiency of both private and public parking options that help maximize revenue, optimize capacity and increase driver satisfaction.
Security and compliance for urban mobility

Urban mobility systems not only manage and store citizen data but also rely upon payment systems, financial data and live feeds from sensors and devices that all require appropriate levels of security, protection and regulatory compliance.

Cities, transport operators and citizens can have concerns about the security of their data and who will have access to it. This is why it is vital for a cloud technology provider to deliver the trust, security, compliance, and resiliency needed by agencies to prove compliance to government regulators and put minds at ease.

While requirements around compliance vary by data use, geography and jurisdiction, Microsoft’s compliance certifications and accreditations are expansive and comprehensive and help government organizations to meet relevant regulations including criminal justice, public safety, tax, trade, education, health, cloud privacy and security.

Microsoft serves a growing community of many millions of cloud customers around the world and uses effective cybersecurity solutions that help protect data, enhance security and scale to meet the requirements of both large and small government organizations. In addition, customers can take advantage of these security technologies, together with the expertise and skilled resources that manage them, when deploying a solution. This helps transport agencies, authorities and operators strike the right balance between security and end-user access, with effective security controls across identity, device, data and apps, and infrastructure. This approach helps protect an agency’s data against unauthorized access, detect attacks and breaches, and can help a government respond and adapt to potential threats.

After four decades of working in the public sector, Microsoft understands the challenges of operating public services in an increasingly mobile-first, cloud-first world where trust is paramount. Microsoft will continue to be committed to developing trusted solutions for government, working with industry partners, competitors, worldwide regulators, global law enforcement and most of all, government customers.
Transforming the journey to modern urban mobility with Microsoft

Flexibility, integration, trustworthiness, openness and a citizen centric approach, all provide strong foundations for Microsoft to partner with governments on their road to digital transformation.

The Microsoft focus on delivering more personal computing, reinventing productivity and business processes, and building the intelligent, trustworthy cloud, supported by a vast network of technology partners, all empower government workers and leaders to do more and achieve more for the institutions, businesses and citizens they serve.

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