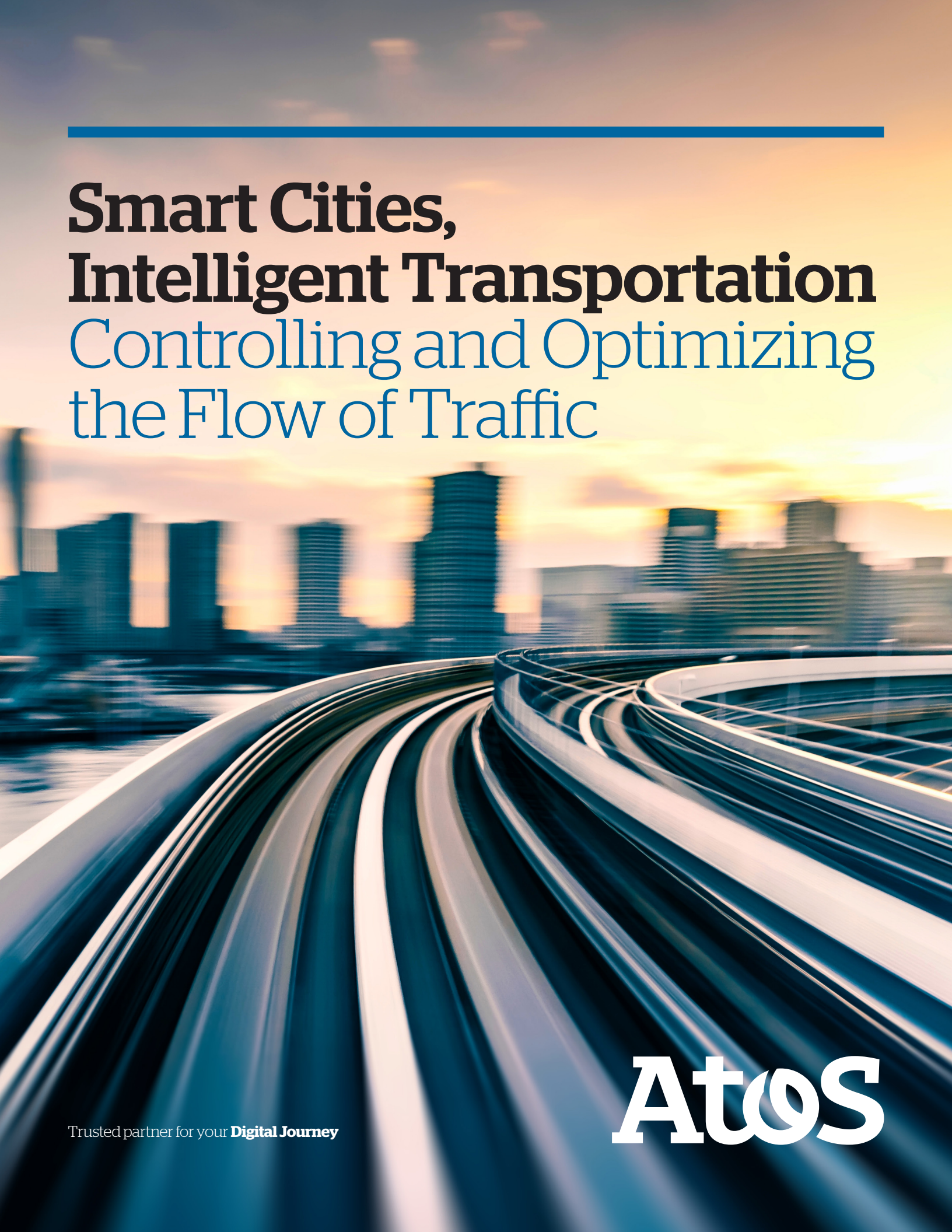


Smart Cities, Intelligent Transportation

Controlling and Optimizing the Flow of Traffic

Trusted partner for your **Digital Journey**

Atos

Introduction

City managers across the U.S. are looking for ways to better control traffic to reduce pressure on infrastructure, improve air quality, and make cities more livable. To that end, they are interweaving alternative modes of transportation, active traffic management, and connected vehicles into an intelligent transportation system.

The focus of smart transportation is to connect the different modes of transportation – bicycles, public transportation, connected transportation, delivery trucks, and emergency medical service (EMS) vehicles – into an integrated system. The objective is to provide citizens with the information they need to make the right choices about which form of travel is best for them to reach their destination. Moreover, smart transportation systems give city managers the ability to better control the flow of traffic and provide the best routes for emergency and law enforcement personnel responding to incidents, as well as trucks delivering goods.

The unprecedented growth of digitally-connected citizens and the ongoing digitization of governments and society increase the need for more real-time data for the government workforce and citizens to make more informed decisions. Cities rely on a massive system of Internet of Things (IoT) sensors, cameras, and mobile devices to gather data about incidents, traffic, and weather. As the volume of data generated through these sensors and mobile technologies continue to grow, cities will need help in harnessing and managing that data for citizens, city services, and partners to co-create healthy and prosperous cities.

Moreover, as a multitude of devices are connected to networks and massive amounts of data are captured from these devices and a variety of sensors, the attack surface for hackers to disrupt the flow of traffic and city operations has expanded. Plus, vulnerabilities increase as insecure hardware and volumes of software are intertwined within a transportation system network.

As a result, cybersecurity is by default one of the biggest challenges facing city officials seeking to incorporate intelligent transportation into the functions of smart cities, said Albert Seubers, Atos' director of global strategy IT in cities. Atos is an IT services company that specializes in high-tech transactional services, unified communications, cloud, big data and cybersecurity services.

Four pillars for cyber-safe intelligent transportation

Four pillars form the foundation of a cyber-safe intelligent transportation system:

1. **City managers and IT cyber teams must understand all the devices that are connected** within this transportation infrastructure. An intelligent transportation infrastructure captures data to help managers and citizens make more informed decisions. However, IT and cyber teams also need to collect data on how each component is operating. Traffic lights, street lights, buses, and bus shelters are all connected. IT cyber teams must determine if these components are working properly or creating other data streams that should be sandboxed and researched.

2. **IT cyber teams must ensure** that connections between data points are secured.

3. **City managers and IT cyber teams must keep abreast** of the latest vulnerabilities that could impact IT systems, networks, and IoT devices. They should employ the services of security vendors and experts that track vulnerabilities and the spread of malware across the globe to stay ahead of the latest attack vectors. This will help government entities put in the appropriate patches and security controls to protect their infrastructure.

4. **City managers and IT cyber teams must implement identity and access management** policies and technology to ensure that only authorized personnel and certified applications have access to data.

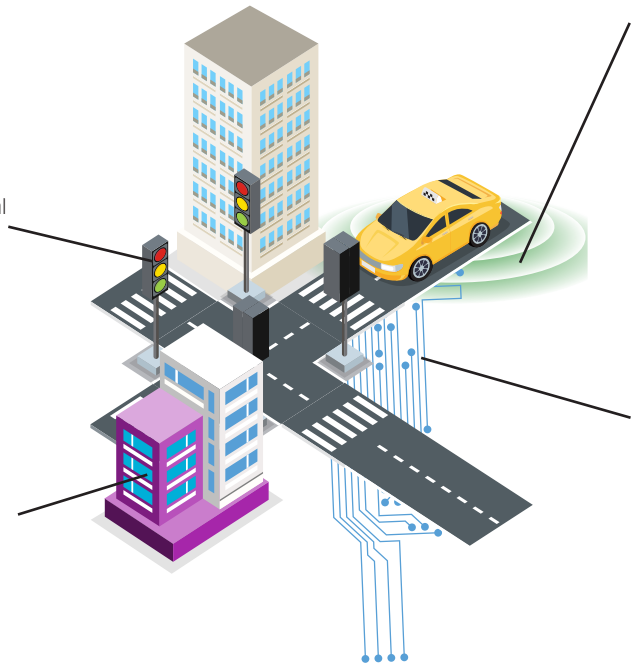
Components of smart transportation

Integrated systems are the foundation of smart transportation. Data captured on traffic situations, parking availability, and options for alternative transport modes should be presented in a single view. This makes it easier for citizens to make travel plan decisions in real-time.

There are several components that add value to an intelligent transportation system, enabling it to provide the real-time analysis required for smooth traffic management. These components include:

Adaptive Signal Control Technology (ASCT),
which connects a series of "smart" traffic signals using fiber optic connections, real-time sensors, centralized control, and sophisticated software. It is a powerful tool for improving traffic congestion within local communities.

Active traffic management,
an approach for dynamically managing and controlling traffic demand and available capacity of transportation facilities, based on prevailing traffic conditions, using one or a combination of real-time and predictive operational strategies.



Sensors,
which help signals determine the frequency of light shifts to ensure that traffic moves in the most efficient manner. Traffic lights can have cameras and sensors attached to them, to help ease congestion and detect highway accidents. Artificial intelligence algorithms will help analyze all of this collected information to improve traffic flow.

Intelligent infrastructure,
which provides fast digital networks, roads with clearly-marked lanes, and traffic signals that are dynamic in nature.

Strong, visionary leadership needed

Strong leadership is needed to ensure that an intelligent transportation system is implemented properly and runs smoothly. City managers have a magnitude of issues on their plate, from overseeing efficient operation of the bus transit system to controlling the flow of traffic for all cars and trucks and ensuring they arrive at their destinations safely and in a timely manner. The success of online companies such as Amazon has resulted in an increase in delivery trucks on roads. Delivery trucks on average attempt to deliver packages 2.1 times. Consequently, cities are looking for alternative ways to deliver packages.

In the city of Amsterdam, Netherlands, delivery companies use boats in the canals for parcel delivery, and the last mile of the delivery is transported by bicycle. This is probably not feasible for a city like Dallas, TX., or New York City, however, it stands out as an example of how city managers in the U.S. must also be visionaries, willing to implement new ideas. Building a smart transportation system is a huge task and it is easy to see why some city managers would shy away from such a job. However, there are steps city officials and their IT and cyber teams can take to ease the burden of the task.

City managers need to:

- Be bold and visionary.
- Be willing to embrace the latest technology.
- Work with a cadre of public transportation and department officials to implement traffic management policies and systems that move away from siloed departments and systems.
- Incorporate IT and cybersecurity management early in the process.

Getting started: building a secure, smart transportation network

1. **Start with connecting the traffic light systems.** A secure smart transportation network starts with connecting the traffic light systems. Add-on technology is available. There is no need for large scale renewal projects, if time-to-green and time-to-red data is available from the existing traffic control system. Connecting captured data into one single data management service allows for flow optimization based on traffic routing. The next phase is to connect selected traffic user groups – buses, trucks, EMS vehicles – by installing on-board units that can communicate with traffic management systems via technology in cabinets located on curbs or sidewalks.

2. **Provide a device health management service to monitor and manage smart devices and sensors from the start, separate from data connections.** Doing this allows managers and IT and cyber teams to track device health and secure connections to the devices.

3. **Use a managed multi-cloud service for data handling to ensure an open ecosystem of third-party vendors is supported.** For data engineering and data analytics, a hybrid cloud environment is necessary to lower the cost of operations.

4. **There is the option to open data access to third-party users.** Apps in commercial trucks, bicyclists and pedestrians will follow. These apps are available for most cases. If third-party applications are allowed access to the data, access management is another security topic that needs to be addressed.

Smart transportation networks in action

Transit buses: Ensuring that buses arrive on time and have priority in traffic is critical if cities are going to make the trans-modal shift promised by intelligent transportation. Communication between buses and traffic lights will help create a conditional priority for buses. For this to happen, an on-board unit in the bus communicates with technology in a curbside cabinet. The traffic light controller (TLC) will share time-to-red and time-to-green data. Depending on the time to arrive at the traffic light, the TLC can change the traffic light setting, halting all traffic for a few seconds to allow the bus to make it to a green light.

If transit authorities want to provide more demand-driven bus services, buses need to be able to deviate from the scheduled route at times and be flexible in routing toward a cross-over location. Road work and major incidents often require buses to deviate from the scheduled route. Communication with users, traffic systems, and other buses is important for success.

Commercial trucks: Smart technology can provide conditional priority to commercial trucks just as it does for buses. A similar on-board unit in the truck would communicate with the TLC, which will share time-to-red and time-to-green data. The TLC would adjust for the truck to allow it to make it through a green light. Providing conditional priority as a service could be a source of income for cities. City leaders could plan transit routes throughout the city. Commercial companies are incentivized to pay for this service as it will save fuel and speed up delivery of goods.

EMS vehicles: This technology gives EMS trucks, and trucks carrying hazardous waste, a default priority. Adding a routing service that allows the central EMS operations desk to schedule different routes for EMS vehicles to the same incident location lowers impact at crossings. Each truck interacts with traffic light controllers that will set all lights to red for an instance and only the truck route to green. After the truck has passed, the traffic light control system will continue to follow the traffic schedule as before. Additionally, prepositioning of EMS vehicles based on analyzing past incident data that tells where likely incidents will happen, will shorten the time to possible incidents.

The Atos traffic management solution

Real-time traffic forecasting: Traffic forecasting is based on historic data. City managers need to understand the impact major events, weather conditions, and traffic patterns during the year will have on certain areas of the city. The Atos Traffic Management Solution can help city managers take a constant measurement of the current flow of traffic: "Then you can start predicting what is most likely to happen based on the regular flow of traffic and how you can optimize your traffic flow," Seubers said. Based on traffic flow information, historic and current, city managers can draw a map of traffic in the city without having to understand the actual roads and be able to predict traffic situations hours in advance.

Traffic management for emergency response vehicles: The flow of traffic is often disrupted as emergency vehicles respond to incidents. At the same time, traffic congestion hampers first responders' ability to get to an incident in a timely fashion. Reports indicate that it takes four cycles of traffic lights to get back to the normal settings after EMS vehicles make it through an intersection. The Atos Traffic Management Solution provides a routing service that allows the central EMS operations desk to schedule different routes for EMS vehicles to the same incident location, lowering the impact at crossings. The centrally scheduled route is pushed to the on-board system of the truck. The truck communicates with the traffic light, indicating for it to set only one lane to green for the EMS truck and red for all other lanes. A few cars can move into a free area of the street after an intersection, and the EMS vehicle can easily flow through traffic. After the truck passes, the pause on traffic will be released and traffic can flow again. Because of the connected traffic light, it does not take as many cycles to get back to the normal flow.

Traffic management for connected vehicles: There are two sides to a connected vehicle. First, the vehicle shares information with the owner about speed levels or upcoming maintenance issues. Second, the same truck could be connected to traffic light information. As the traffic light sends out "time-to-green" information, a connected truck could calculate the average speed needed to make it to a green light. Instead of idling at a red light, the truck driver could save fuel and reduce emissions.

Smart parking: Smart parking apps are available to help point drivers directly to available spots. Cities are now able to deliver real-time information about routes and arrival times on digital signage or via mobile apps, which enables riders to make travel adjustments on the fly, helping them avoid long delays. Smart parking technology typically uses sensing devices such as cameras, vehicle counting equipment, and sensors installed in pavements to determine occupancy of the parking lot. However, what makes parking smart is the combination of traffic information, parking availability information, and knowledge of alternative transportation. A combination of these three components makes journey planning smarter.

The Atos Traffic Management Solution can help ease gridlock, offering intelligent syncing of traffic signals to prevent backup at intersections, and real-time navigation alerts to help drivers avoid accidents, construction, and congestion. As a result, drivers can choose the fastest route.

The integrated traffic management system also works with smart parking apps to point drivers directly to available spots. Additionally, the Atos Traffic Management System optimizes call centers and field operations along with traffic signal preemption to give emergency vehicles a clear driving path. Smart transportation technology can provide patients with a coordinated trip to the hospital, improving communications between the EMS service and the hospital. Patient handover time is reduced, and the hospital emergency service team is better prepared for a patient's arrival.

An Atos' intelligent transportation system lets city managers collect and analyze data on public transit usage and traffic to make better decisions. They can modify bus routes or have a better idea of where to install traffic signals, turn lanes, and bike lanes. All these capabilities are available in a single solution that lets city officials manage and improve traffic flow, reduce congestion, and improve public safety.

Atos offers critical elements to secure smart transportation

Six elements are needed to securely bring intelligent transportation together: technology and technology integration, endpoint security, data management, governance, vulnerability management, and prescriptive security.

Since there are many ways to deal with an issue, technology integration is crucial for interconnecting best-of-breed solutions. Therefore, Atos partners with security providers such as McAfee and ForeScout to make sure devices are secure, and also partners with a host of start-ups and established vendors to provide cities with the best technology to meet their specific needs.

In this era of connected devices that ingest massive amounts of data, data management is crucial. Major industries have many endpoints with lots of data flowing in to predict when production lanes will be out of order or when equipment might wear out and break down. Maybe, one of the computers that connects various systems is the cause of problems. In industry, visibility of all the interconnections is known as a "bridge view." Atos' view of data management is much like that bridge view, providing visibility into data from its origin, through the multiple ways data is presented, and onto the endpoint where people are reading the data.

City managers and IT and cyber teams must be able to manage the data and be transparent without releasing data. To that end, identity, access, and privacy management are important pieces that fall under the umbrella of governance. Governance focuses on what the data is used for, who is accessing the data, and supports the various use cases for the data. "All these elements must be managed. Without governance a project will fail," Seubers said.

What the future holds

The future is difficult to predict, but clearly trends are pointing toward autonomous vehicles.

Proponents talk about how safe autonomous vehicles are and how they can be used. Opponents point to reported mishaps, such as the autonomous Uber vehicle which struck and killed a 49-year-old woman in Tempe, Arizona in March 2017.

Although fully-driverless technology is still at the advanced testing stage, partially automated technology has been around for the past few years. For instance, executive sedans like the BMW 7 Series feature automated parking and can be controlled remotely. Meanwhile, Ford plans to launch a self-driving ride service in 2021. Washington D.C. will be its second launch city after Miami, where Ford is already testing.

Autonomous vehicles rely on a range of sensors to interact with the world around them. As a result, car manufacturers must tackle a range of technical and ethical challenges before autonomous vehicles can be deployed in cities nationwide. Connections between cars and traffic infrastructure will be essential for enabling autonomous driving.

Additionally, new attitudes about where and how people work will impact the development of intelligent transportation. Companies select cities for headquarters based on the flow of traffic. All of this creates the need for alternative transportation. People should not have to take cars to their endpoint destination if other modes of transportation are available.

From a technology perspective the goal is to lower emissions and promote environmental-friendly spaces. From a city design perspective, the goal is to promote more auto free zones and alternative transportation. As for citizens, "we will get more information to understand the alternatives we have and employ smart journey planning to stay ahead and not be surprised by congestion," Seubers explained.

"There will always be traffic and cars on the street. But today, if you can take 10 percent of cars off the main road, there will be no traffic jams unless there is an incident," he said.

The bottom line

Transportation is increasingly becoming more connected as part of ongoing smart cities and states initiatives.

Cities are connecting transit and working on multi-modal systems to facilitate easier and quicker commutes that efficiently move people and goods throughout a region.

Since this requires a great deal of data, city managers will look to the private sector to develop technology that can collect, store, analyze, and visualize that data. This information can lead to the development of mobile applications that let people purchase tickets for buses and other transit through one streamlined application.

As data comes from multiple systems and from different vendors, all using their selected cloud partner, a managed hybrid cloud orchestration strategy is needed with high-compute power in the core for data analytics.

As the lead systems integrator, Atos works with cities and selected partners to provide a holistic view of information that helps in the development of innovative smart city services.

The pillars for a successful intelligent transportation system include:

1. Secured, managed federated IoT platform.
2. Visualization of connected elements on the city network.
3. Cybersecurity operations service.
4. Managed multi-cloud data collection.
5. Managed and secured hybrid cloud platform for data engineering and data analytics.
6. Identity and access management.
7. Governance and operations management.
8. Data monetization based on volumes and transactions.

Digital technologies are enabling traffic to be radically optimized by interconnecting people, vehicles and infrastructure. As an experienced innovator in transport, Atos is ready to help city managers move into the new digital landscape. Atos can help cities engage with travelers from the moment they begin to think about their journey all the way to their destination, giving them the real-time information needed to change routes and mode of transportation on the fly.

About Atos

Atos is a global leader in digital transformation with 120,000 employees in 73 countries and annual revenue of € 13 billion. European number one in Cloud, Cybersecurity and High-Performance Computing, the Group provides end-to-end Orchestrated Hybrid Cloud, Big Data, Business Applications and Digital Workplace solutions through its Digital Transformation Factory, as well as transactional services through Worldline, the European leader in the payment industry. With its cutting-edge technologies and industry knowledge, Atos supports the digital transformation of its clients across all business sectors. The Group is the Worldwide Information Technology Partner for the Olympic & Paralympic Games and operates under the brands Atos, Atos Syntel, Unify and Worldline. Atos is listed on the CAC40 Paris stock index.

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Let's start a discussion together

To learn more about Atos' traffic management solutions for smart cities:
https://atos.net/en-na/north-america/local-government-cities