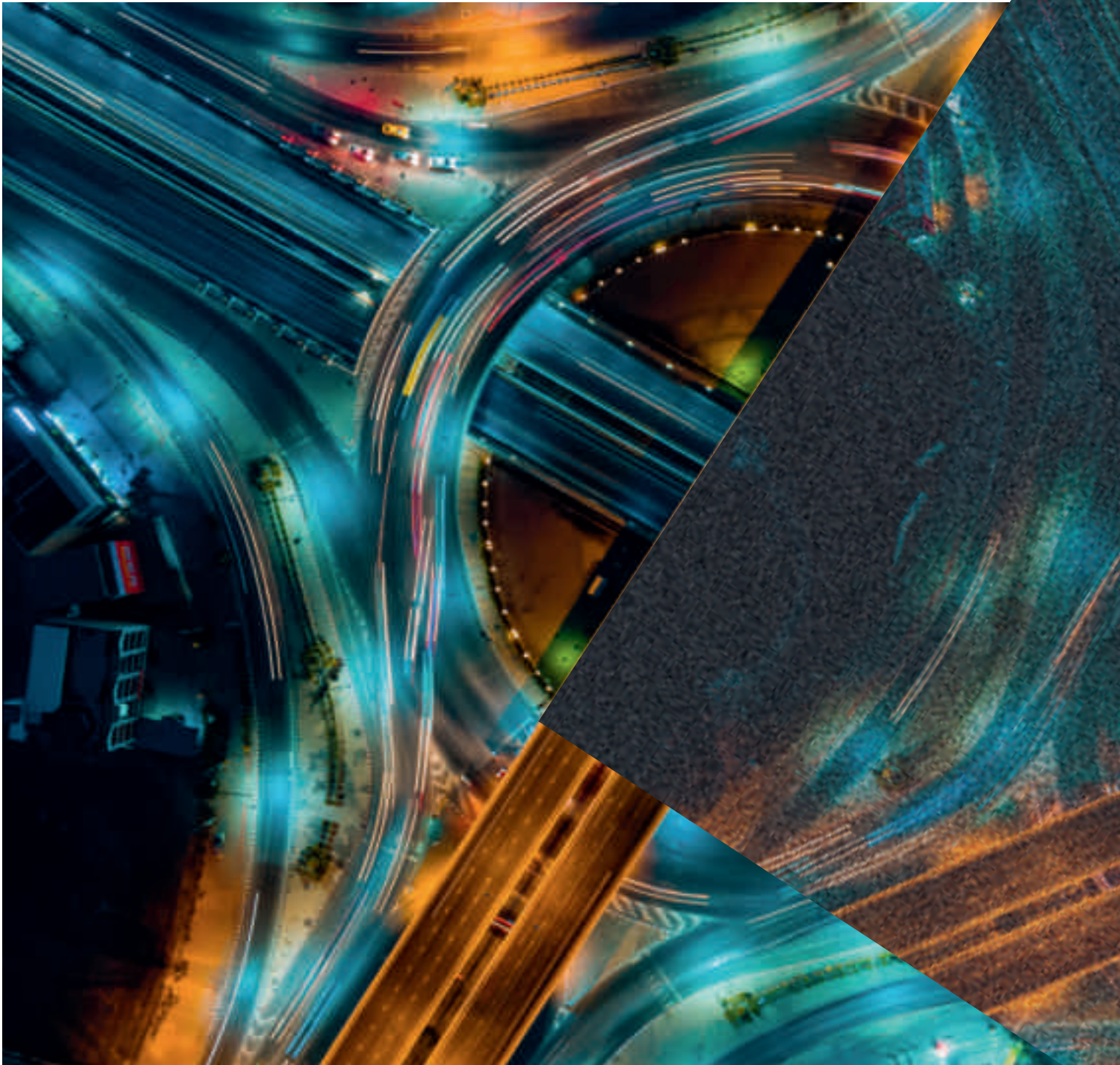


A futuristic city street at night, illuminated by vibrant neon lights in shades of purple, blue, and red. The architecture is modern and layered, with buildings and structures that create a sense of depth and complexity. In the foreground, a white, spherical vehicle with a circular window and a small antenna is parked on a cobblestone-like surface. The overall atmosphere is one of a high-tech, urban environment.

future URBANITY

Strategies for reinventing
the urban realm

P A R T 1





The path to a
seamless urban
public transport
system

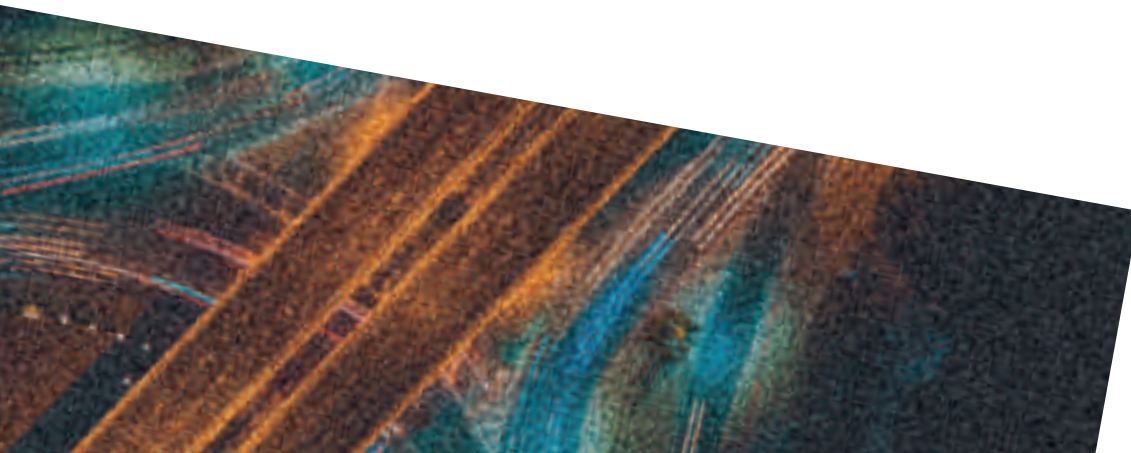
The author



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I've been working in the transit industry for 12 years. When I look back, I'm amazed to find that the industry is a lot more innovative than you'd think. It introduced the first contactless cards 20 years ago and the first ticket machines 50 years ago – with a choice of tickets to make the driver's job easier. And the industry is a pioneer in digitalisation too. Transit companies are quick to recognise and implement innovations and the customer benefits they can produce.

So it's no wonder that the Internet of Things has already arrived in our industry. We can see lots of potential and opportunities that will be accelerated with 5G. And this will turn the industry completely on its head. I'm looking forward to being a part of this journey.



HOW MOBILITY-AS-A-SERVICE OPTIMISES PUBLIC TRANSPORT

Increasing levels of urbanisation and of competition for road space – such as from e-commerce and mobile grocery deliveries – place a significant burden on street traffic in cities. The coronavirus pandemic in 2020 added to this by causing a dramatic reduction in public transport passenger numbers, as many commuters chose to use their cars or work from home. Currently, about 4 billion people live in urban areas. Today's urban traffic and transport systems are self-contained and already under pressure. They will not be able to deal with the expected increase in traffic volumes – given that the World Bank predicts the number of people worldwide living in urban areas to double by 2050¹. Against this backdrop, and with all other things being equal, overcrowding and delays will reach unprecedented levels.

Even if the coronavirus pandemic has led to a slump in the use of public transport, transit operators will regain passengers in the medium term by optimising their strategies. With the continuing increase in urbanisation, our cities will soon reach their limits if things stay the same as they are today.

A better perspective for the future is a mobility-as-a-service approach that combines public transport systems into a single, seamlessly integrated service that allows users to flexibly change between whichever transit methods will get them to their destination. At the heart of this vision is the fact that switches should be as easy and intuitive for users as possible. To facilitate this, they should be able to plan and pay for their entire journey across all types of transport with their smartphone.

Required would be an app that gives them real-time information and – where necessary – suggests route changes so that they can get to their destination as fast as possible or in a way that suits their personal preferences. These preferences could include the cheapest, most sustainable or least busy connection, for example. In addition, this type of MaaS app could recognise individual route patterns and use them to provide personalised trip information.

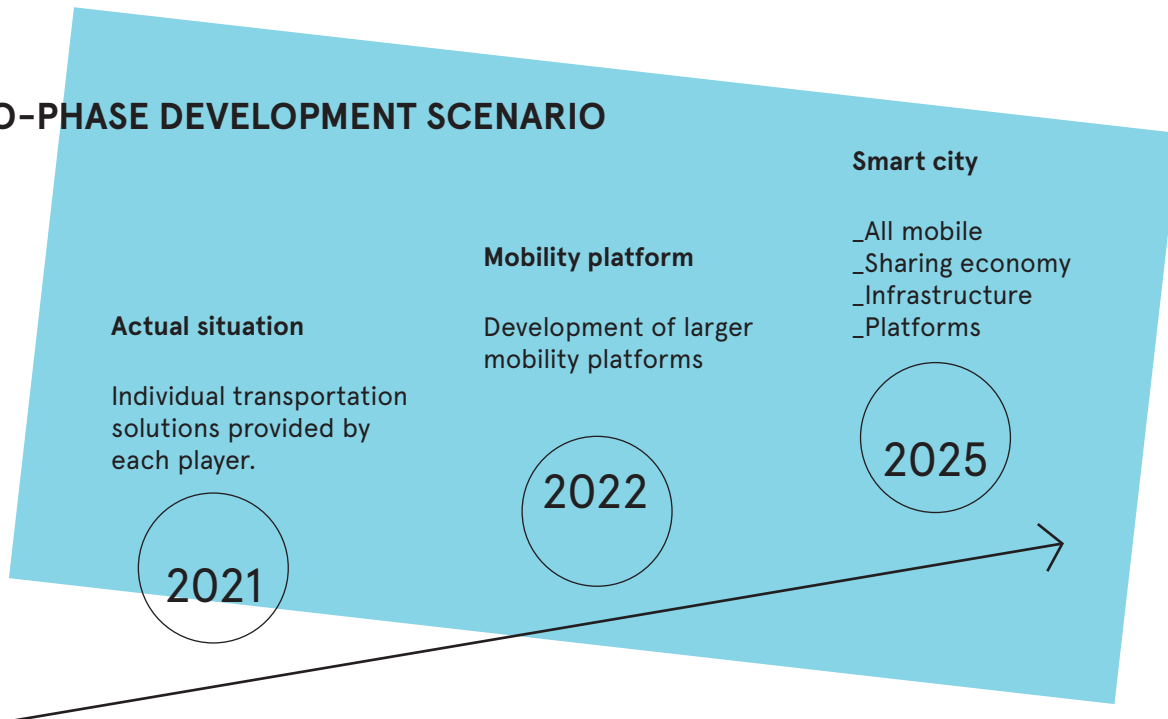
¹ World Bank, „Urban Development“, 2020

The journey from analogue passenger transport to Future Urbanity, in the sense of a seamless, urban public transport system, should be achieved in two main phases:

_Creation of urban mobility platforms for the integration, communication and centralised control of various transit methods and infrastructures and the involvement of the different partners. The aim is to ensure an intelligently-interlinked transportation offering covering the entire city.

_Transformation from mobility-as-a-service in a town to a smart city – the actual goal is the creation of a seamless, urban public transport system.

TWO-PHASE DEVELOPMENT SCENARIO



The mobility platform is only an intermediate step towards the smart city. Mobility is still important and will play a major role.

URBAN MOBILITY PLATFORMS AS THE FIRST STEP

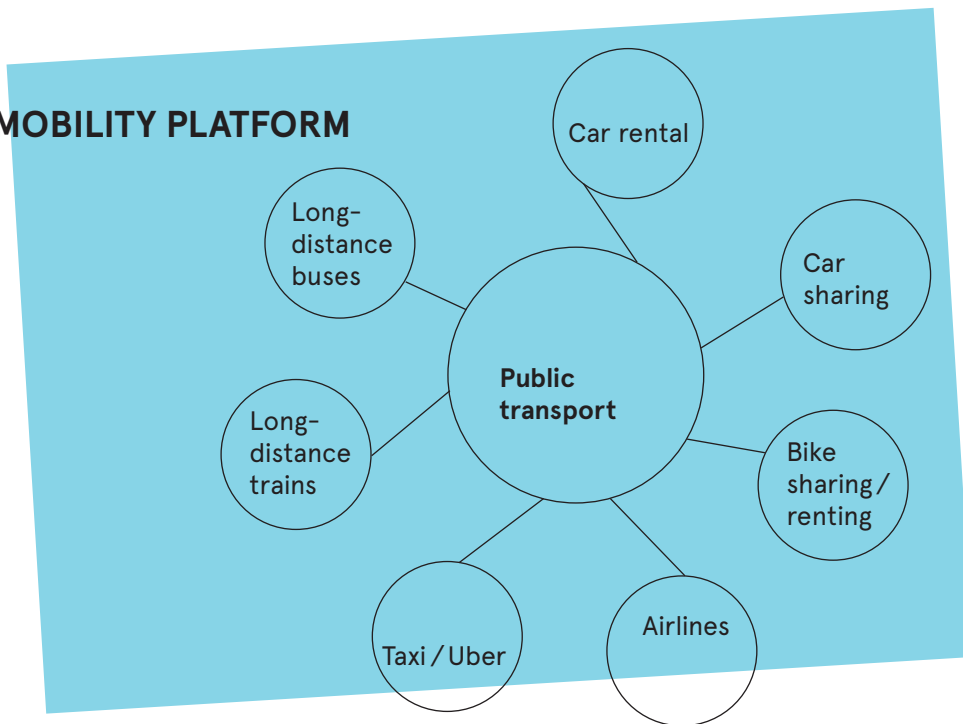
In order to implement the “15-minute city” vision², which enables people to reach any point in the city within 15 minutes on sustainable transport, the local public transport operators – and therefore the city’s transport authorities too – must be at the heart of the future urban mobility strategy.

As the orchestrator of an IoT-based urban transport platform, the city sets the standards that can be leveraged by mobility providers, including car rental

companies, car / scooter / bike sharing services, taxi firms, ride-hailing services through to buses and trains. The platform interconnects these with its various transport infrastructure components like streets, car parks, platforms, recharging stations etc. and ensures smooth communications between them.

This is the only way to achieve the goals of seamless switches between transport types, real-time information about all available transport methods, dynamic route planning and easy payment – from a single source and a mobile customer interface.

URBAN MOBILITY PLATFORM



Public transport will be the nucleus of further developments towards a mobility platform.

² <https://www.bloomberg.com/news/features/2020-11-12/paris-s-15-minute-city-could-be-coming-to-an-urban-area-near-you>

The *implementation of urban mobility platforms* depends to a large extent on digitalisation and the technologies that comprise it.

MILLENNIAL GENERATION DRIVING DIGITALISATION

Seamlessly-integrated urban mobility is particularly appreciated by millennials (born between 1981 and 1996). At just under 32% of the world's population, they are the largest age group³.

Surveys show that 66% of the under-30s expect to be able to use a mobile ticket on public transport and that 33% of all users think they should be able to buy their ticket with their smartphone⁴. This is why it is essential that transport authorities meet millennials' needs and enable payment on mobile devices.

PREREQUISITES FOR URBAN MOBILITY PLATFORMS: MOBILE TICKETING AND DIGITAL ID

Secure mobile ticketing and digital identification are key elements in a MaaS solution. They protect the user's identity and personal data in multiple mobility apps and enable them to easily create an account, set up payment methods and access all the public transport they need. With G+D solutions, transport authorities can easily generate, deliver and manage secure digital identities, and assign virtual tickets to mobile devices. Along with the authentication of customers renting a car, e-scooter, bike etc., remote identification helps avoiding waiting times and time-consuming preparations.

The one-time ID registration enables users who have already signed up with one city's mobility app to automatically access a car, bike, bus or train in a different town without having to go through the whole process again.

³ Condor Ferries, „Millennials Travel Statistics & Trends“, 2020

⁴ G+D, Oxford Economics

BENEFITS OF URBAN MOBILITY PLATFORMS

- _All available means of transport provided on one platform
- _Each individual user can seamlessly, easily and intuitively switch between the means of transport best for them**
- _All services can be planned and paid for with the user's smartphone using a MaaS app
- _Tickets are secured on the smartphone**
- _Real-time information and suggestions for route changes
- _Solutions for the first and last mile**
- _Transport on demand
- _Mobility is made more efficient (comprehensive transport offering, more choice, less dependence on private cars)**

TRANSFORMATION TO A SEAMLESS URBAN PUBLIC TRANSPORT SYSTEM (SMART CITY) AS THE SECOND STEP

The transition from an urban mobility platform (Maas) to a fully-fledged smart city concept achieves the real strategic goal of a seamless public transport system, which is future urban mobility. The aim is to build an intelligently interconnected transport offering for the entire town with the inclusion of all transport infrastructure elements like traffic lights, guard rails, escalators and car parks as well as traffic flow optimisation. Both areas should fall under the sovereignty of public authorities. In the smart city, citizens are connected with intelligent municipal services in various ways because the city's devices and data are integrated in the town's infrastructure and services. The citizen can access these services quickly and easily with their smartphones.

CONNECTIVITY IS THE KEY

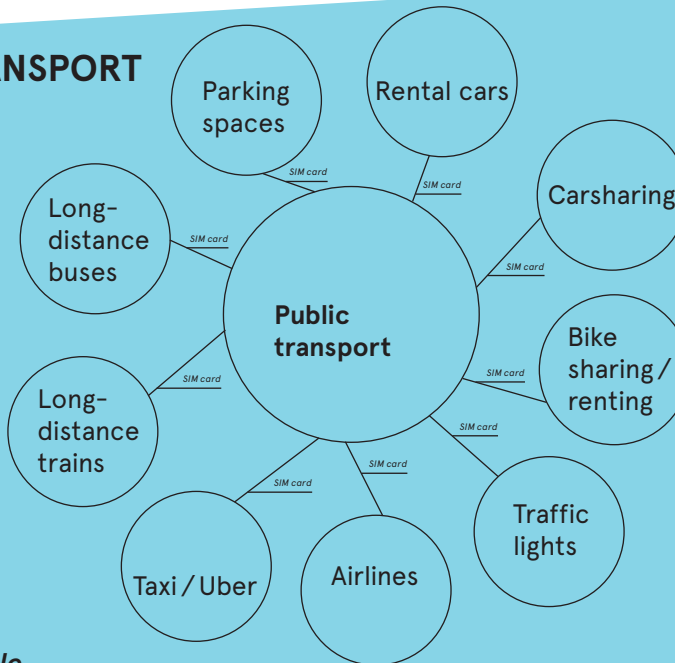
The Internet of Things (IoT) is still booming. More devices, machines, cars and objects are connected and multiple new business models are emerging. Mobile connectivity is becoming more important for practically all market sectors. To ensure smooth connectivity for urban transport infrastructures, SIM cards are a prerequisite – and they are present in bikes, escalators, vending machines and even traffic lights. With that in mind, the transformation to a smart city will be driven by the adoption of 5G technologies. eSIMs will help transport authorities to leverage the potential of 5G.

LEVERAGING 5G POTENTIAL IN SMART CITIES WITH eSIMS

Unlike conventional standard SIM cards, eSIMs (embedded SIMs) are seeing increased use. They are installed permanently as a small chip in devices and cannot be removed or replaced. The devices, cards and connectivity are managed by an eSIM management solution.

With the eSIM Management solution from G+D, organisations can download the profiles of the embedded cards over the air. That makes it much easier and more straightforward to provision the eSIM and select a mobile provider.

SEAMLESS URBAN PUBLIC TRANSPORT SYSTEM (SMART CITY)



In the mobile world, all components are interconnected and provide valuable information. They are connected via mobile networks and the relevant SIM cards.

Another advantage here is that it is easy to change a SIM profile during the lifespan of one device and to move an existing profile to a different device. This higher level of flexibility improves control over connectivity, reduces logistics costs and simplifies processes in multiple use cases.

The IoT solutions from G+D support secure data sharing between the end devices in the infrastructure, the users' mobile devices, and the transport authority's cloud platform. These solutions are essential to ensure permanent communication and connectivity between devices while protecting important infrastructures and data from attackers and hackers.

BENEFITS OF A SEAMLESS URBAN PUBLIC TRANSPORT SYSTEM (SMART CITY)

The benefits of intelligent urban transport systems are already proven today. For example, local tests with traffic lights that detect vehicles and communicate with each other in real time – in order to allocate driving lanes according to traffic volumes – showed that commuting time was reduced by up to 20% in Buenos Aires and by 15% in Houston⁵.

In San Francisco and in Johannesburg, intelligent parking guidance systems, which connect vehicles with parking infrastructure and inform users in real time about available parking spaces, were able to significantly reduce the time drivers needed to find a free space⁶.

Based on traffic flow data in Seattle, a simulation compared data from one car's "selfish" routing system, which calculates the best route for itself, with data from a "balanced" routing system that calculates the best route for all vehicles. It showed a possible reduction in traffic of 73%⁷.

These technologies will enable traffic authorities to resolve problems more easily and optimise maintenance planning (predictive maintenance). This will give them significant cost reductions and quality advantages – for example, by avoiding damage from wear and tear on infrastructure components and the resulting service interruptions. That can produce 50% fewer outages, 40% lower maintenance costs, and 70% less machine downtime⁸.

5 *Dynamo, „Traffic Management Explained“, 2020*

6 *McKinsey, „The Road to Seamless Urban Mobility“, 2019*

7 *Roadshow, „Ford quantum computing experiment cuts traffic, commute times“, 2019*

8 *Maschinen Markt, Newsletter Juni 2018*

The *analysis of millions of journeys* in the whole network will give cities *valuable insight* into transport usage patterns and user behaviours. This also provides transport operators with huge cost savings potential.

These data will be generated in multiple places in a smart city and should be processed in a meaningful way. As soon as a city knows in real time how many people are using which form of transport and on what routes, it can manage the use of mobility resources more effectively – from long-distance and underground trains to trams, buses and staff.

In addition, they can resolve malfunctions in the network more efficiently if they are able to guide commuters onto different routes or means of transport by sending them updated journey plans on their mobile devices. Cities can also detect and forecast peak capacity during rush hours.

By using dynamic pricing for mobility-as-a-service offerings and optimising the placement and equipment of mobility infrastructure like bike and e-scooter hubs, transport authorities can actively manage capacity utilisation on their networks to avoid overloading it. They can also devise new services and business models.

CONCLUSION AND PERSPECTIVES

Digitalisation is entering all areas of our lives and is the trigger for accelerated development in mobility and the public transport infrastructure. Towns are continuing to grow and will need to modernise their urban infrastructure and involve all relevant partners – including the private sector – to achieve the goal of becoming a smart city.

The focus for all actors must be to provide what customers want: easy and safe travel from door to door, anytime and from any starting point, that they can plan and pay for on their smartphone. The millennials' requirement for digital and app-based services and for sharing concepts must be fully taken into account.

The analysis and definition of the services important to residents could be a first step.

Public authorities are the owners of traffic and transport infrastructure and are neutral and secure data instances. As such, it is their responsibility to manage this century task. Important milestones include the creation of a mobility platform that unifies and delivers services from all public and private providers, as well as the continuous analysis of the data collected in order to improve these services further.

The goal is a smart city that thinks ahead in order to constantly extend and optimise its offerings. The technical basis for this is provided by IoT and cloud platforms to collect data, then analyse and process it for use in new and improved services for citizens.