

Travel of tomorrow

Innovation for the future of integrated, intermodal transport

Siemens examines the key stakeholders of a modern transport network to define how a personal mobility companion can transform regional mobility

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Introduction

As the number of people moving to and within cities increases, several challenges present themselves in regard to urban transportation. To start with, public transport systems often do not meet demand with respect to capacity, comfort or safety, which means people continue to rely on their cars to get around. The result: stifling congestion and high levels of pollution. Yet even in cities with functioning public transport networks, people still continue to rely on their cars. One of the reasons is that there is usually little integration of the different transport modes, as well as a lack of corresponding information according to (real) time and place. That means users of public transport have to plan their journeys minutely - and these plans have to be altered on the fly if a train or bus isn't operating according to schedule. Complexity increases even further if additional modes of transport like the increasingly popular shared services for cars or bikes are considered. To come up with an ideal transportation system, it pays to examine the requirements of the primary stakeholders: travelers, operators and urban authorities.

"Mobility can now be seen as an information service with physical transportation products, rather than a transportation product with additional services."

From "The world is changing. Transport, too." A 2016 study requested by the European Parliament's Committee on Transport and Tourism



The stakeholders

Travelers

Travelers expect the same degree of convenience in public transport as when they take their car – without traffic congestion. In many cities, even those with a functioning public transport system, cars and taxis are the dominant mode of transport for getting around. Blocked roads become the norm. Slowly, though, the mindset is changing. For the younger generation, "sharing" transport models like car and bike sharing enjoy widespread acceptance. Car ownership is losing its appeal. Instead, flexibility is becoming more and more important, namely the flexibility to take the mode of transport that best suits one's current transportation needs. Users of these services generally are not interested in who operates them.

Finally, smartphones and apps have developed to such an extent that it is possible to be guided throughout an entire journey with a smartphone serving as a personal mobility companion. Later in this paper we will accompany a family of four on the way to the airport. Their journey will give readers an idea of how technology can make a trip more enjoyable and worry-free.

Operators

For their part, operators are interested in providing a convenient journey to attract and retain passengers and increase their own revenue. Under these circumstances, many operators are making significant investments in their capacities and networks. It is also not uncommon for operators to enter adjacent fields of mobility and invest in new transport modes such as car sharing and demand-responsive transportation to better meet passenger needs and provide transport from the first to last mile. Particular climate challenges, for example extreme heat in the summertime in the Middle East, make this model increasingly attractive. In many countries, new service operators are also entering the market and working alongside incumbent operators.

To deal with increasingly tight budgets and in order to improve the passenger experience within stations, operators are looking at new models, such as transport-oriented development (TOD). A TOD is a mixed-use commercial and residential area with easy access to a transit station or stop. Transit operators stand to benefit from renting out commercial and residential space in TODs. As an example, Dubai Metro's Union station already shows the potential of this concept. Some are even going a step further and developing shopping malls in TODs, such as MTR in Hong Kong. There, the money earned with TOD activities is helping subsidize fare collection, which alone is not sufficient to finance operations. As such, MTR is able to do without government subsidies. It is estimated that 60 percent of MTR's total income comes from property rentals.

An overall aim for operators is to provide an attractive customer experience. Ease of use plays a major role in this context. Therefore, operators are increasingly offering integrated ticketing for various modes as well as making it easy and convenient for travelers to combine various transport modes. And by doing so, they are making a big contribution to releasing pressure from an overcrowded road network.



50 HOURS

Amount of time the average driver wastes per year searching for parking



57 PERCENT

Share of travelers looking for ways to optimize their journeys



Number of people who want locationbased information

Urban authorities

Governments and administrative bodies are in global competition for talent, tourists and economic development. Therefore, cities and regions have to provide an excellent quality of life to be a relevant destination and place to live. What this translates into are jobs, a healthy environment and opportunities for social interaction. Efficient transport is one important tool among others to support this target. Modern, IT-based mobility solutions bolster the image of innovative and attractive cities.

In addition, public transport helps cities lower energy usage and meet their sustainability goals. Dr. Andreas Kopp from the Worldbank confirms: "Energy efficiency is achieved by a high share of public transport in cities, and particularly by a high share of rail passenger transport. What's more, energy efficiency generates health benefits through reduced air pollution."

Furthermore, cities can use their public transport networks to foster innovative industries. A prime example is using a public transport system as a testing ground for IT-based transport innovations, such as Singapore has done with its "living lab" for innovations in transport. Projects like this serve to draw even more talent and add to a city's attractiveness.

A vision for the future of transportation

Siemens has taken the needs of these three target groups into consideration to come up with a vision for transportation in cities. A key element for the implementation of this vision is the personal mobility companion on the traveler's smartphone. The companion proactively offers all necessary information for each situation and location for a smooth journey. It helps navigate the user to the final destination using all transportation modes and operators. Furthermore, the companion enables ticketless payment and helps with transactions such as booking a shared car or reserving a parking space. Services for disabled people or those requiring special assistance are also part of the offering.

The personal mobility companion positively impacts operator revenue by offering a more attractive traveler journey, which in turn draws more travelers and increases their willingness to pay for services that enhance their experience even more. And for urban authorities, an excellent passenger journey experience becomes a way to drive economic development and quality of life, while at the same time reducing the burden on the environment.

But what does this mean in practice? Let's follow the Meyer family on their way to the airport. The smartphone is charged and the app has been installed. Ready to go!

Siemens SiMobility solutions enable enriched mobility offerings to make travel easy and increase customer satisfaction – as experienced by the Meyers





Intermodal transport to the airport with the Meyer family

A relaxing start to a great holiday

The big day has finally arrived. The Meyer family – father Chris, mother Ella and the two kids, Lilly and Ben – is departing for a two-week vacation. Getting to the airport can be stressful. "What if there's a traffic jam and we miss the plane?" asks Ben. "That's not going to happen," responds Ella, because she knows she can rely on the personal mobility companion to get the family to the airport with plenty of time to spare. After all, both she and her husband have used the app several times for their business trips.

Before the family sets out the door, Chris enters into his smartphone the airport as the final destination and the preferences for the journey. Because they are traveling with four suitcases, he tells the app to choose a route that requires as little walking and stair-climbing as possible, and of course no bike sharing. In just seconds, the journey is mapped out.

What seems relatively simple is in fact quite complex. The IT backbone that powers the app brings together data from a number of sources – mobility service providers, traffic management headquarters and other transportation users, to name just a few. This data is used to suggest routes, offer practical alternatives if accidents or delays occur, and help choose the best means of transportation. Trips can also be optimized from an economic or environmental perspective.

The app also enables end-to-end bookings across a variety of transportation types, and when necessary, it books seats too. Thanks to the IT backbone, during the journey the Meyers can actively be advised about restrictions, changes or alternative services. In addition, mobility providers can also offer their customers individual value-added and bonus services. Finally, the system manages payment for all mobility services used, supporting all payment processes between the mobility service provider and the user at a central level.

The various transportation services and completed routes can be registered using mobile phone ticketing or card-based solu-

tions. Passengers then pay only for the services they have used – based on the cheapest charging option in each case. Everyone in the mobility chain profits from the system: Travelers have the convenience of intermodal travel, transparent travel information in real time, a larger range of mobility services thanks to cooperation with numerous service providers, and an attractive pricing model. For operators, the transportation service offered by the IT backbone can be structured more attractively, impediments to access can be reduced and passenger numbers increased, which also means a higher turnover. Urban authorities also benefit from the way the backbone works as an effective tool that supports traffic control, enables citizens to plan their routes conveniently, improves capacity utilization of infrastructure, provides information about transportation requirements, and thus also contributes toward a system of traffic management with a focus on the environment.

As an example, the Open Mobility Berlin project from November 2012 to October 2015 was a showcase for bundling relevant services across different modes of transportation. The project integrated data on road traffic and parking from more than 15 different mobility providers. Included in the mix was information on real-time and scheduled public transport (train, metro, bus, tram), road traffic, parking, car and bike sharing, taxis and even stations to charge electric cars. To plan an intermodal trip, users could enter their starting point and end destinations along with their travel preferences, namely which modes of travel they wish to use. Trips could also be optimized for travel time, cost, distance and CO_2 emissions. Real-time information provided the traveler with data relevant for the journey. In much the same way as the personal mobility companion used by the Meyer family.

Open Mobility Berlin demonstrated how a variety of services for planning and routing, booking, ticket transactions and real-time information could be made available to travelers. Experience from this initiative is now being leveraged in multiple applications internationally.



Flexibility is becoming more and more important, namely the flexibility to take the mode of transport that best suits one's current transportation needs.

On-demand minibus

The first leg of the journey is being covered with an ondemand bus. Thanks to flexible routes and stops, the Meyer family is picked up directly at their front door. After everything is loaded into the minivan, Chris gets a message that they will arrive at the metro station in 11 minutes. Normally the family boards the metro to the airport at the central station, but today road construction is holding up traffic at the central station, so the personal mobility companion has routed the Meyers to another metro station. On the way, two more guests join them in the minivan. Sharing the ride means savings for everyone, as the fare is dynamically reduced according to the number of passengers. The environment also benefits, because there are fewer cars on the road.

In this vehicle, though, no cash is exchanged with the driver. Instead, a sensor detects when the family has entered the minivan. The price is calculated automatically and is based on the distance traveled and the overall trips made during the day. As such, the best price is guaranteed. The same sensor detects when the Meyers alight.

Buses operate according to a clear schedule and fixed stops, right? Yes, but not always – and definitely not in the case of demand-responsive transport. Demand-responsive transport models have proven their value in Scandinavia and North America. On-demand buses like the one that takes the Meyer family to the metro station have no set route to follow. Instead, users enter into their smartphones their starting and end points. In the background the system collects all similar requests and calculates a bus route that optimally fits the needs of all travelers. The price for demand-responsive transport is generally lower than a taxi, yet more than for a regular bus.

Ticketing is accomplished with the "Be-in, Be-out" (BiBo) system. By the end of 2016, a BiBo project will be operational at Swiss South Eastern Railway (SOB) in Switzerland. With this system, a ticket is automatically issued when entering a vehicle. The end of a trip is also automatically registered without passenger interaction. Passengers are ensured the optimal price, as previous uses of public transport are subsequently considered and an overall best price is calculated. This feature is a boon to occasional users of public transport. The optimization can take place over a period of time, such as a day, week or month. Traditional systems require the passenger to choose a price option in advance, such as a day, week or month pass – mostly in a dreadfully complex system of fees.

For the next part of the Meyers' journey to the airport, BiBo ticketing is used again. But first, they have to navigate their way through the station to the platform.



Operators aim to make it easy to combine various transport modes including integrated ticketing. By doing so they reduce barriers to using public transport and improve the modal split, which together contribute to a sustainable urban transport landscape.

Interchange made easy

The Meyers have arrived at the metro station. None of the four are very familiar with the station – they usually board the metro at the central station. But not to worry: the personal mobility companion jumps to life, ready to guide the family through the station to the appropriate platform. Pictures on the smartphone screen show the next turns and which elevator to take. The app rules out stairs, which are hard to navigate with baggage. Similarly, mobilityimpaired passengers can also be routed according to their ability.

The app relays a message that the metro will be a bit late. A kiosk in the station on the way to the platform sends a coupon: four drinks for the price of three. Ella wouldn't mind a coffee, and the kiosk also has juices for Ben and Lilly. Chris would like some water. So on the way to the platform, the Meyers pick up some drinks and still get to the train with plenty of time to spare.

The beacon infrastructure at the station and the app plug-in communicate via Bluetooth Low Energy, and the back-end system delivers the appropriate content to the smartphone. Push messages or widgets can be used to proactively supply any information relevant in the given context to the passengers entering the transport operator's structures (stations or platforms). All kinds of data such as (modified) departure times, waiting times, cancelled connections, operator's messages, etc. can be communicated within seconds. With this information, passengers can permanently optimize their daily commute, avoid unnecessary delays and make good use of unavoidable waiting times. The passengers are provided automatically with up-to-the-minute information that perfectly fits their individual needs and specific route.

For transport operators the system opens up a new and additional channel for communicating with passengers, and it is also a tool for generating anonymized passenger flow data. Quantification of passenger numbers as well as the analysis of aggregated passenger movement profiles enable operators to optimally adapt and manage their mobility services.

Interaction with passengers and a better response to the imminent mobility demand can have a positive impact on the utilization of the services and help limit or optimize the use of individual transport modes for the overall transport network. There are also numerous opportunities for promoting the operator's own and third-party offers.

This beacon-based concept has been deployed successfully in many cases, such as for promotional offers or to help people find their way in museums, shopping malls and transportation hubs. In Villach, Austria, a beacon-based system has been installed to help guide tourists through the region. Besides providing details on different attractions, it also supplies information on public transport connections. The service is also perfect for deployment at airports.



The final leg

The metro pulls into the station and the Meyers board, baggage and all. Upon entering the train, a beacon system similar to the one installed in the on-demand minibus and in the station registers its new guests and issues a ticket. As they get closer to the airport, the excitement increases. When they get off the train 25 minutes later at the airport, they are automatically checked out. At this point, the Meyers have basically completed their journey to the airport.

The beacon system at the airport takes over and guides the family to a baggage check-in point in the metro terminal, so they don't have to wheel their bags all the way to the central check-in desks. And after the bags have been dropped off, the Meyers are guided to their gate.

In the meantime, the IT backbone calculates the fees for the journey. A text message is sent to the phone with the bill for the complete journey. The two modes of transport – the minibus and the metro – are both included in the single bill. If other modes of transport had been used, such as car-sharing or taxis, they would also have been covered within the single invoice.

Arrival at the holiday destination

It can be a lot of fun and a great adventure to discover a new place for the first time. Nevertheless, after an exhausting journey help to get to the hotel quickly and easily is welcome. So the Meyers are delighted to have the services of their personal mobility companion after landing.

The personal mobility companion has not only taken care of getting the Meyers to the airport on time, comfortably and for a price much lower than taking a taxi – they also arrive relaxed at their holiday destination. From the time the Meyer's preferences were entered into the smartphone, the family could relax and enjoy the journey, knowing that they are fully taken care of.

One of the biggest advantages in this system is that there is no need to carry cash. Furthermore, the best price is always guaranteed, so travelers don't have to study fares and calculate the best combination.

Back home

Two weeks later, the Meyers are back at the airport – the family had an excellent vacation. While they are waiting for their bags at the carousel, Ella turns on her phone. After quickly scanning her mail, she opens the personal mobility companion. Starting point: airport. Final destination: home. The app does the work, and the Meyers can sit back, relax and look forward to being home again.

Travel of tomorrow

All three stakeholder groups – travelers, operators and urban authorities – profit from this new approach to transportation, which is only possible with integrated, innovative technology. For the vision above to become reality, technologies need to be implemented today, piece by piece. After all, such a vision cannot become reality overnight. People are also not going to abandon their cars from one day to the next. Instead, they have to try out the technologies and see how they work – to convince themselves of the advantages and to experience the flexibility for themselves.

In regard to the public transport companies, the focus will vary. In cities like Cairo where capacity is a major constraint, adding new lines and increasing seats should be the focus. In cities like Stockholm or Berlin, however, capacity is adequate and it would be better to invest in quality. Technology can maximize the potential of existing systems.

In the last three to four years, the benefits and modalities of an integrated transport system have been discussed widely in conferences and forums all over the world. The different players have in the meantime reached a consensus and many are moving in a similar direction. Transport models of tomorrow are starting to crystallize.

A key driver in this regard has been technology, which has been tested widely and has proven to work. The different stakeholder groups have accepted it and recognized its value for their needs. The next step is to integrate the technology into business models.

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