

Whitepaper
November 2019

Smart ticketing, *enabled by*

ITSO



**Why ITSO plays a
fundamental role in
the development
of Mobility as
a Service**

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Mobility as a Service (MaaS) is a mobility model that relies on digital platforms to integrate end-to-end trip planning, booking, electronic ticketing, and payment services across all modes of transportation in an urban setting.

It is a marked departure from where most cities are today, but it is a concept that has captured the attention of the transport community and government alike. Rather than having to locate, book, and pay for each mode of transportation separately, MaaS schemes let users plan and book end-to-end trips using a single app or platform.

It has the potential to change dependence on private vehicles and deliver seamless mobility. Through MaaS, travellers could have access to easy, flexible, reliable, price-worthy and problem-free transit from A to B.

ITSO is uniquely positioned to link ticket fulfilment with journey planning, aggregation, identity, payment, mobility and real-time journey information.

Passengers can travel seamlessly across transportation networks with only their smartphone or other wearable device.

Steve Wakeland
Executive Chairman

This report will cover the many aspects that contribute to the successful delivery of MaaS in cities and the actions that need to be taken to achieve a fully interoperable transport system, with a focus on mobile ticketing as the missing link in MaaS.

We recognise that some of the definitions of mobility services are contested. Within this document we use the following definitions:

EMV: a credit or debit card with an embedded microchip and associated technology designed to enable secure payment at compatible point of sale (POS) terminals.

Mobility as a Service (MaaS):

the integration of various forms of transport services into a single mobility service accessible on demand. MaaS should be the best value proposition for users, allowing them to see what the choices are and helping to meet their mobility needs.





e-Ticket: an electronic ticket that is purchased online and transmitted to the passenger in the form of a digital barcode which is scanned at ticket gates either on their phone or using a printed copy.

m-Ticket: a mobile barcode ticket, scanned by a QR reader or used as a flash pass.

Ride hailing: the process by which a rider “hails” or hires a personal driver to take them exactly where they need to go. The transportation vehicle is not shared with any other riders, nor does it make several stops along a route.

Ride sharing: the process by which a rider shares a vehicle with other riders. It is not personal transportation, as the space is shared and the vehicle will make stops along the route to pick up and drop off other riders.

Shared mobility: the shared use of a vehicle, bicycle or other transportation mode to allow users access to transportation services on an as-needed basis.

Smart city: a city that incorporates information and communication technologies (ICT) to enhance the quality and performance of urban services such as energy, transportation and utilities in order to reduce resource consumption, wastage and overall costs, while enhancing quality of life factors for people living and working in the city.

As urban populations continue to rise, MaaS aims to enable people to travel across different modes of transport, easing congestion and tackling pollution from road traffic, while meeting the demands of the modern passenger.

In today's fast-paced world, people expect the same instant, uninterrupted access to public transport they experience in all other aspects of day-to-day life. Currently only a small number of cities are successfully delivering MaaS schemes to the public, but it is a concept that is discussed extensively by governments across Europe and the rest of the world.

An integrated public transport system is crucial for the delivery of a fully functioning MaaS scheme and it is impossible to achieve this without smart ticketing. For example, the limitations of the UK's current ticket system are clear. There are 55 million different fare combinations on the national rail network, making ticket purchasing overly complicated for passengers across the UK¹.

While the rail industry has launched 'Easier fares for all'², a review of fares and ticketing to try and combat this issue, it relies on operators being willing

to work collaboratively to enable passengers to travel across different networks in the simplest way possible, using one device.

To reduce the cost of travelling longer distances on trains, passengers are faced with working around a complicated ticketing system, which is the opposite of what MaaS seeks to achieve. The transport industry wants to work together to simplify ticketing and as a result, provide an uncomplicated and easy-to-use public transport system that meets the needs of all types of passenger.

"There are 55 million different fare combinations on the national rail network, making ticket purchasing overly complicated for passengers across the UK."

A simplified, smart ticketing solution will benefit passengers using all modes of transport, enabling a quicker, more convenient and flexible travel experience and encourage greater use of public transport.

ITSO Ltd is the guardian of the ITSO Specification, which enables smart ticketing technology, and is well placed to assist with ticket fulfilment, the missing link to providing MaaS in the UK. Changing passenger demands must be taken into account in the development of smart ticketing solutions to best meet their needs.

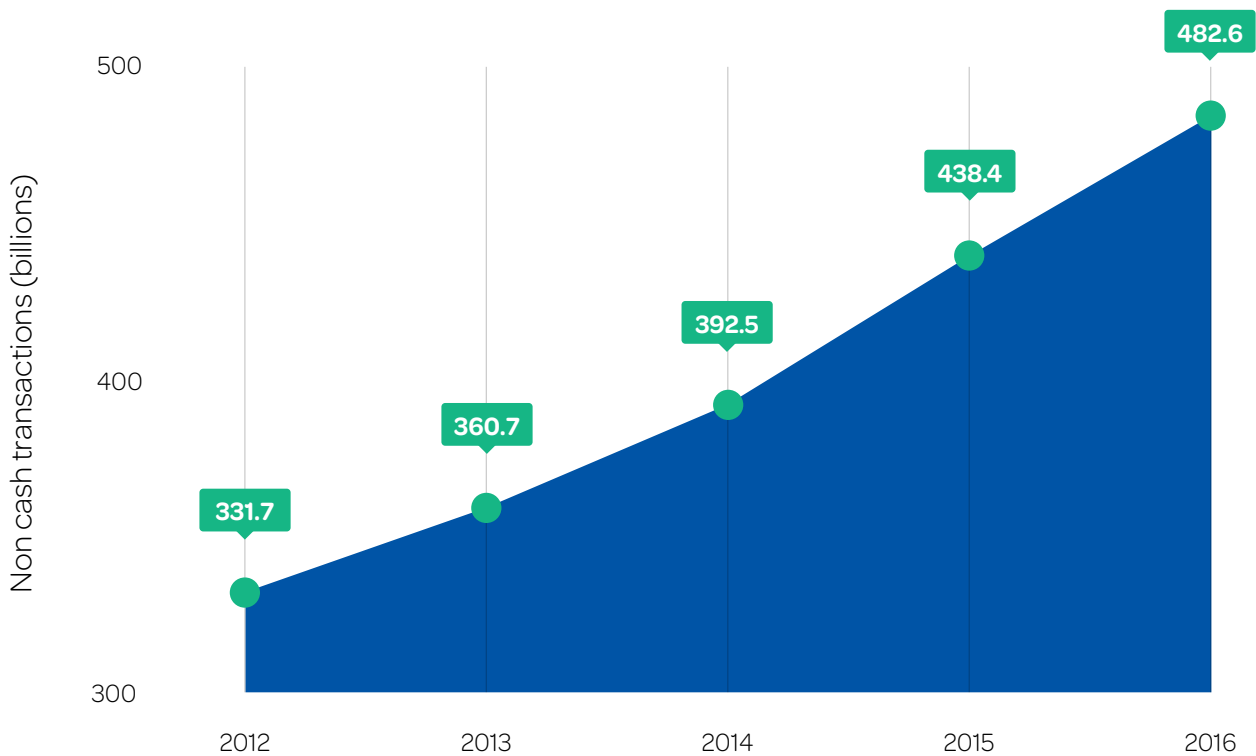
ITSO's place in MaaS is to provide the connection between the transport operators or ticket retailers and the technology companies that provide mapping services and electronic wallets. Once these sectors can collaborate, effective MaaS schemes will begin to emerge in the UK.



¹ 'Easier fares for all' Rail Delivery Group proposal, February 2019. Page 9.

² 'Easier fares for all' Rail Delivery Group proposal, February 2019.

Number of global non-cash transactions 2012-2016*



Over the past few years, the UK has seen a significant shift towards digital payments across all industries. One in ten adults and one in six young people are now cashless³, with contactless and mobile payments exploding in popularity. One in six UK adults are also now registered for mobile payment services such as Google Pay and Apple Pay, up from 2% in 2016⁴.

Passengers want the ability to pay for, download and access their tickets all from their smartphone. ITSO Transit Hub's mobile ticketing solution ITSO on Mobile meets this expectation by emulating a standard ITSO smartcard virtually on a passenger's smartphone. The secure ticket is delivered over the air by ITSO Transit Hub's ticket fulfilment service, which is integrated with the operator's retail system and with Google Pay.

³ 'One in ten adults have gone cashless, data shows' The Guardian, June 2019

⁴ 'One in ten adults have gone cashless, data shows' The Guardian, June 2019



1 in 10 adults &
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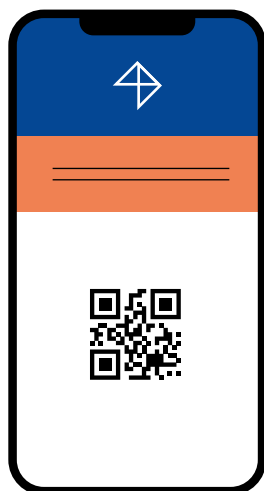
Smart ticketing types

Paper tickets have long been the default of the UK transport industry, but the industry is now seeing a real shift towards smart ticketing.

New industry figures show that just half of all journeys (50%) are now taken using paper tickets, down from over 63% in 2018⁵. Paper tickets have their drawbacks, including the time it takes to purchase a ticket at a station and their vulnerability to fraud. The right smart ticketing solution will be essential as technology evolves and passengers' daily dependence on smartphones grows.

There are multiple smart ticket types currently available, including physical smartcards, onto which passengers digitally load their tickets, and mobile-based smart tickets. Within mobile ticketing, there are different solutions:

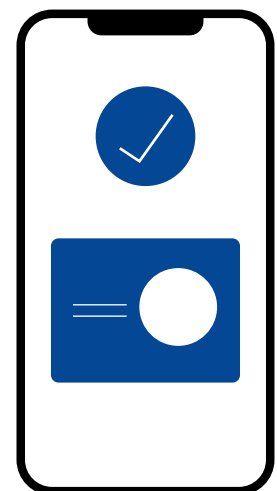
- An **m-Ticket** is a mobile barcode ticket, scanned by a QR reader or used as a flash pass.
- An **e-Ticket** is purchased online and emailed to the passenger in the form of a digital barcode which is scanned at ticket gates either on their phone or using a printed copy.
- **ITSO on Mobile** enables the virtual replication of a ticket on a smartphone, meaning passengers can benefit from all the advantages of a traditional smartcard while only needing to carry their phone with them on their journey.



mTicket



eTicket



ITSO on Mobile



“In 2018, 22% of rail journeys were made using smart tickets, up from 7% in 2013.”

⁵“Smart train tickets reach tipping point as paper tapers off”, Rail Delivery Group press release, October 2019

What role does mobile ticketing play in MaaS?

Technology plays a fundamental role in our everyday lives; helping us to communicate, learn, shop and experience.

Our preferences and habits are rapidly changing because of tech, as is the way we navigate the world around us.

Public and private transport must keep up with this evolution. MaaS will drive the way passengers expect to travel and interact with operators, as they push for efficient transport systems and seamless travel.

Smart ticketing is on the rise. Between 6th January and 3rd March 2019 14.1 million smart tickets were sold in the UK, equivalent to 1,200 km of orange paper tickets laid out back to back, or the return distance from London to Edinburgh⁶.

There are also currently an estimated 20 million plus smartcards in circulation across UK rail, bus and tram networks, with ITSO enabled smartcards in use on 95% of the UK's bus network.

Contactless payments, using EMV and tap and go technology, have seen the most rapid rise in recent years. Transport for London says contactless payments now account for around 50% of transactions on its network⁷ and 12.5% of these journeys are carried out using smartphones. There is clear demand for this type of payment to connect modes of transport.

“MaaS will drive the way passengers expect to travel and interact with operators, as they push for efficient transport systems and seamless travel.”





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+

12.5%

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⁶ 'Just the smart ticket': more rail passengers than ever before can go paperless Rail Delivery Group press release, April 2019

⁷ 50% of all TfL pay as you go journeys are made using contactless payments, SmartRail World, 2018

Access to different mobility modes is easier when carried out with a single app or device.

According to the MaaS Alliance, a public/private partnership promoting MaaS in Europe, the models “offer added value through use of a single application to provide access to mobility, with a single payment channel instead of multiple ticketing and payment operations.”⁸

For passengers, smart ticketing streamlines their travel, meaning less time spent queuing at ticket machines, or searching for the correct change. Instead of keeping track of several paper tickets for multiple transport modes, mobile ticketing, allows passengers to travel seamlessly, keeping all their virtual tickets in one digital wallet. Their smartphone becomes their ticket: a single device that unlocks access to several types of transport.

ITSO has a key role to play linking transport operators to the big tech companies that provide mapping and digital wallets. Through our technology, passengers could use an ITSO MaaS tag through a mobility app on their smartphone, allowing them to search

for a journey, purchase a ticket and travel seamlessly between bus, rail, tram, bike, taxi and other options. MaaS joins these dots and the ITSO Standard is agnostic to all types of transport.

With the evolution of MaaS comes the need to maintain trust and to protect passengers. The Department for Transport launched its report, ‘The Future of Urban Mobility: Urban Strategy’ in March 2019. Its guiding principle is that “new modes of transport and new mobility services must be safe and secure by design.”⁹

When ITSO Transit Hub developed and launched ITSO on Mobile¹⁰ in 2018, security was a priority. Working closely with Google Pay, a security solution was co-designed. For MaaS to work, passengers must trust that their details will be safe, even across large networks. To ensure the safety of transaction data transport operators will be keen to work with providers and big tech companies that have security ecosystems in place.



⁸ ['What is Maas?' The Maas Alliance](#)

⁹ ['The Future of Mobility: Urban Strategy', p.8. Department for Transport, March 2019](#)

¹⁰ [ITSO on Mobile launches with Google Pay, November 2018](#)

What are the benefits of mobile ticketing over EMV/tap and go?

Since 2012, Transport for London passengers had the option of travelling through London using a contactless payment, or EMV, card, instead of a smartcard or paper ticket.

Today, around a billion journeys are made on Visa cards per year, with contactless payments accounting for around 50% of transactions on TfL's network¹¹. The transport industry expects this number to continue to rise.

Contactless cards provide a way of travelling efficiently by eliminating the need to queue at a ticket machine or keep track of a physical ticket. They also enable access to multiple mobility types, allowing passengers to move

between different forms of transport if contactless is accepted as a payment method, a good start for MaaS.

However, despite the growth of contactless cards being used to pay for and access public transport, they have limitations.

These could be resolved by mobile ticketing solutions, such as ITSO on Mobile.



In London, TfL allows passengers using a contactless bank card to be charged a weekly cap for their travel. But for all other transport operators contactless is only currently viable as a means of paying for short journeys that cost less than the current £30 maximum daily cap for single contactless payments, although some are starting to implement fare capping now.

With contactless also comes the inability to buy tickets in advance, and passengers may not find out the exact fare they will pay before embarking on their journey. Unlike EMV, ITSO on Mobile offers pre-travel payment options, allowing passengers to confirm the fare they will be charged when purchasing the ticket, which is essential for passengers making longer journeys across the UK.

Moreover, when it comes to travel, contactless cards are only currently feasible in transport systems where

there are set zones and a maximum daily charge.

With approximately 55 million different fares available on the UK rail network, the ‘tap and go’ technology of EMV cards is too simplistic to navigate these various fare combinations, a barrier to MaaS, but could be used within certain inner city areas.”

Smart ticketing technology needs to be able to handle complex fares and ticket types for passengers to travel across the UK with ease.

Due to ITSO Transit Hub’s sophisticated back office, ITSO on Mobile’s smartcard emulation technology enables passengers to buy and download a variety of ticket types including daily, weekly, season and other, and have access to the best available fares at their time of travel.

¹¹ [Analysis of contactless pay as you go journeys](#), Transport for London

¹² [Pay as you go caps](#), Transport for London

There is much debate over the role of the car in MaaS schemes, and whether MaaS should focus solely on public transport; or also include taxis, ride shares, micro-mobility and even potentially autonomous vehicles.

There are lessons to be learned from examples of MaaS we see in action in Europe.

One of the world's first examples was established in the German city of Hanover. Hanover's Mobility Shop¹³ integrates registration, routing, booking and billing for several transport modes in the city. This includes public transport, but also taxis and car sharing. The service offers users the ability to tailor their travel bundle to their individual needs and receive a monthly bill. Journeys can be researched and booked via the GVH App and include real-time travel information.

In Finland, for the past two years residents in Helsinki have also been able to use a single app, Whim¹⁴, to plan and pay for all modes of public and private transportation. Whim connects the travelling public with train, taxi, bus, car share and bike share operators and allows them to either use pay as you go or pre-pay for all services as part of a monthly mobility subscription.

Both these models represent a revolution in mobility, changing how the public interacts with transport daily, but also how technology can alter habits – encouraging people into initiatives such as car or taxi shares, reducing congestion in cities.

Breaking down the barrier between transport modes enables a seamless journey. Transport for London currently provides live public transport data to 675 mobile phone and online apps including Citymapper and Citymapper, Uber and Google Maps. Uber, the ride-hailing app which positions itself as a 'marketplace' for transportation, now shows users in London the fastest and cheapest way to travel between destinations using the London Underground and buses, in addition to private car hire. Users can also see ticket prices and real-time public transport updates.

Away from taxis or car shares, there are arguments that the private car can have a place within MaaS models.

¹³ Uestra.de – Mobility shop, city of Hannover

¹⁴ Whimapp.com

¹⁵ [TfL to give customers better information about their Tube journeys](#), May 2019

¹⁶ Citymapper.com/London/rail

¹⁷ [Uber integrates Transport for London info into app](#), Financial Times, April 2019



With the UK government set to ban the sale of petrol and diesel cars by 2040¹⁸, there is a growing shift towards hybrid or electric vehicles and reducing CO₂ emissions.

Travelling by personal vehicles is set to become greener, and the transport industry needs to continue to include the car in transport planning. There should be careful consideration of the role of the car in 'first/last mile' journeys – the joining up of a final transport stop with the last mile to a passenger's home or workplace. For rural areas this is particularly important where there may be less public transport infrastructure.

In August 2019 Google Maps announced that users would be able to combine multiple transport types when journey planning in their app, illustrating their recognition of this issue.¹⁹

Electric vehicles could be integrated into a MaaS model, with apps providing journey planning and highlighting the charging points for points for vehicles en route, in conjunction with public transport options. Smart ticketing could enable electric vehicle drivers to plan their route to a train station, book their parking, pay to charge their vehicle and buy their rail tickets, all within one smartphone app.

In

May 2019, the West Midlands Local Industry

Strategy¹⁹ was released. It proposes the creation of the UK's first Future Mobility Zone, testing new technologies between Birmingham, Solihull and Coventry. This will include establishing infrastructure to support development of local charging points and energy transmission systems for electric vehicles across the region.

Smart ticketing technology can play a key role in the adoption of greener forms of transport and assist with integrating the car into MaaS models, facilitating a smooth journey between personal and public transport modes. Importantly, MaaS solutions will be able to provide passengers with all their transport options. Realtime travel data and live traffic conditions will give them the information they need to decide whether using their car will be the fastest way to complete their journey.

¹⁸ UK plan for tackling roadside nitrogen dioxide concentrations, Department for Transport, October 2018

¹⁹ Travel your first and last mile with Google Maps, Google, August 2019

²⁰ West Midlands Local Industry Strategy, Department for Business, Industry & Industrial Strategy, May 2019

MaaS in practice: what we have learned

In late 2019, the government will publish its findings from the Williams Rail Review²¹.

This will outline how the UK can develop a world-class railway that fits seamlessly into the wider transport network, following a push by Keith Williams to move the rail sector towards “integrated transport networks, with modes working together to provide a seamless journey²²” for passengers. Williams added that “digitisation of ticketing is an obvious place to start – this would support integration, could deliver major benefits for passengers and costs savings for the industry.” But, he added, “rail is a long way behind.”

It is not only the digitisation of ticketing that will be key for passengers, but the way in which technology can be utilised to connect ticket purchase and fulfilment with journey planning and ticket storage.

ITSO on Mobile was launched with Transport for West Midlands in 2018 and initially rolled out on the West Midlands Metro tram network²³. The Swift on Mobile app²⁴ lets passengers purchase, fulfil and use an ITSO-compatible ticket on their mobile phones, with the ticket on the handset emulating a standard ITSO smartcard.

Integrating with transport retail mobile applications and websites, ITSO on Mobile securely delivers purchased tickets, within seconds, directly to the Google Pay digital wallet on the phone. The smart tickets are instantly recognised by ticket validator machines or gates. The smartphone serves as both ticket machine and ticket to provide an end-to-end solution.

For Transport for West Midlands, smart ticketing is a key part of its plan to integrate rail services in the area with bus, tram, cycling and walking options. Swift on Mobile is set to extend beyond trams in early 2020.²⁵ This solution, allowing passengers to purchase and store multiple tickets for different forms of transport all on their smartphone, will support further adoption of MaaS in the region.

²¹ [Williams Rail Review](#), Department for Transport, March 2019

²² Keith Williams, speaking at [Accelerate Rail](#), March 2019

²³ [ITSO on Mobile launches with Google Pay](#), November 2018

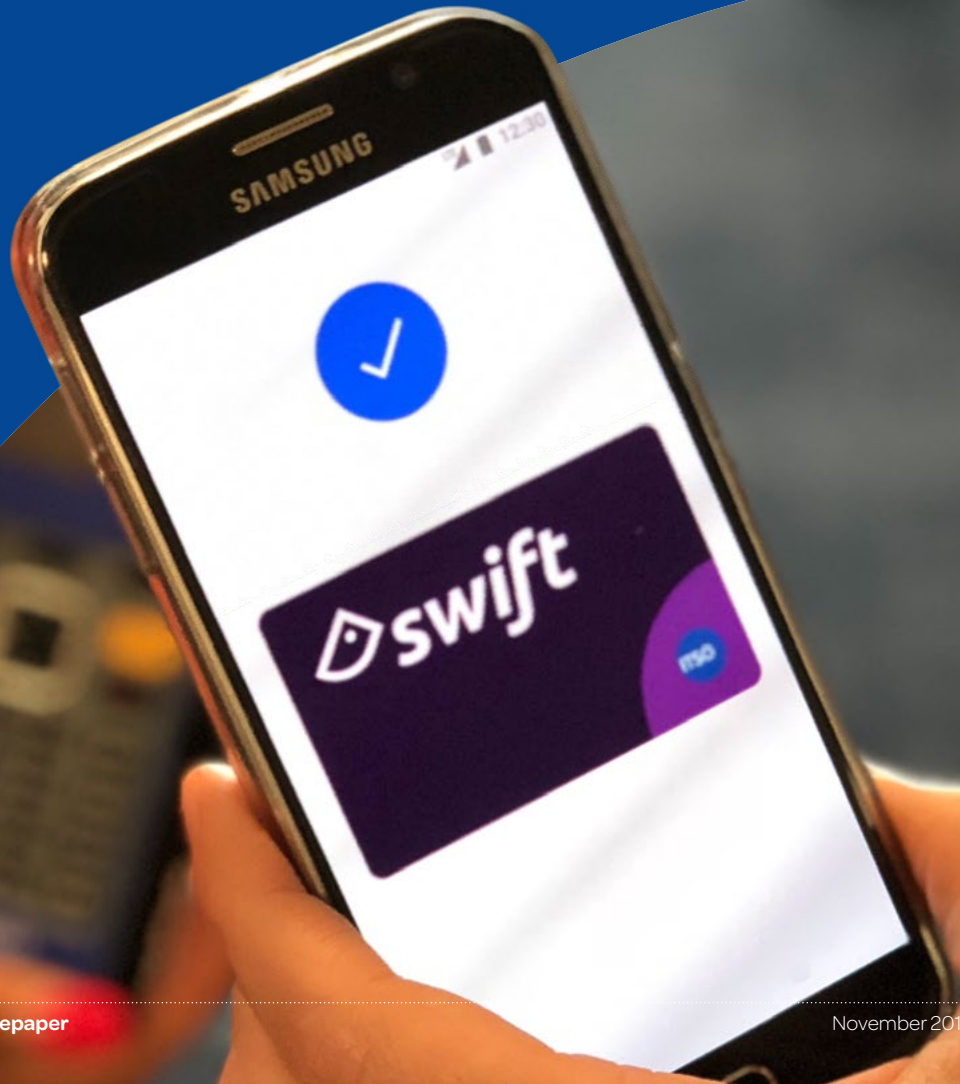
²⁴ [Swift on Mobile](#), Network West Midlands

²⁵ [ITSO enabled Swift on Mobile launches on West Midlands Metro](#), Rail Professional, March 2019

There are other bonuses. Data collected from the ITSO enabled Swift smartcard, and Swift on Mobile app is being analysed to assist with transport planning. Transport for West Midlands is particularly interested in understanding hotspots across its network as it plans for the future extension of the West Midlands Metro route.

With the existing ITSO infrastructure in place across the UK transport network, ITSO Ltd is well placed to drive immediacy in delivering smart ticketing

for passengers. Using MaaS apps via their smartphone gives passengers the freedom to move across MaaS platforms operated by different service providers, buying and storing tickets in the digital wallet on their smartphone. ITSO's current technical integrations with Google, for example, ensures smooth adoption of MaaS models, linking payment with mapping and live journey updates.



Predictions for the future of ticketing and MaaS

The move towards MaaS will require increased collaboration over the next few years between big tech companies, transport operators, digital retailers and standards bodies.

We believe that open standards and open data are essential to create a seamless travel experience for passengers and that collaboration across the industry will drive change and remove friction. Greater data sharing and tapping into the availability of open transport data will also determine how quickly MaaS is adopted.

With smartphones such a fundamental part of daily life, passengers will demand more mobile services and expect the transport industry to keep up with changing technology trends. We expect route planning and ticket purchasing apps to become fully integrated with each other so smartphone users will not have to switch between apps to plan and pay for their journeys.

Google has now implemented an API that enables a user to search for

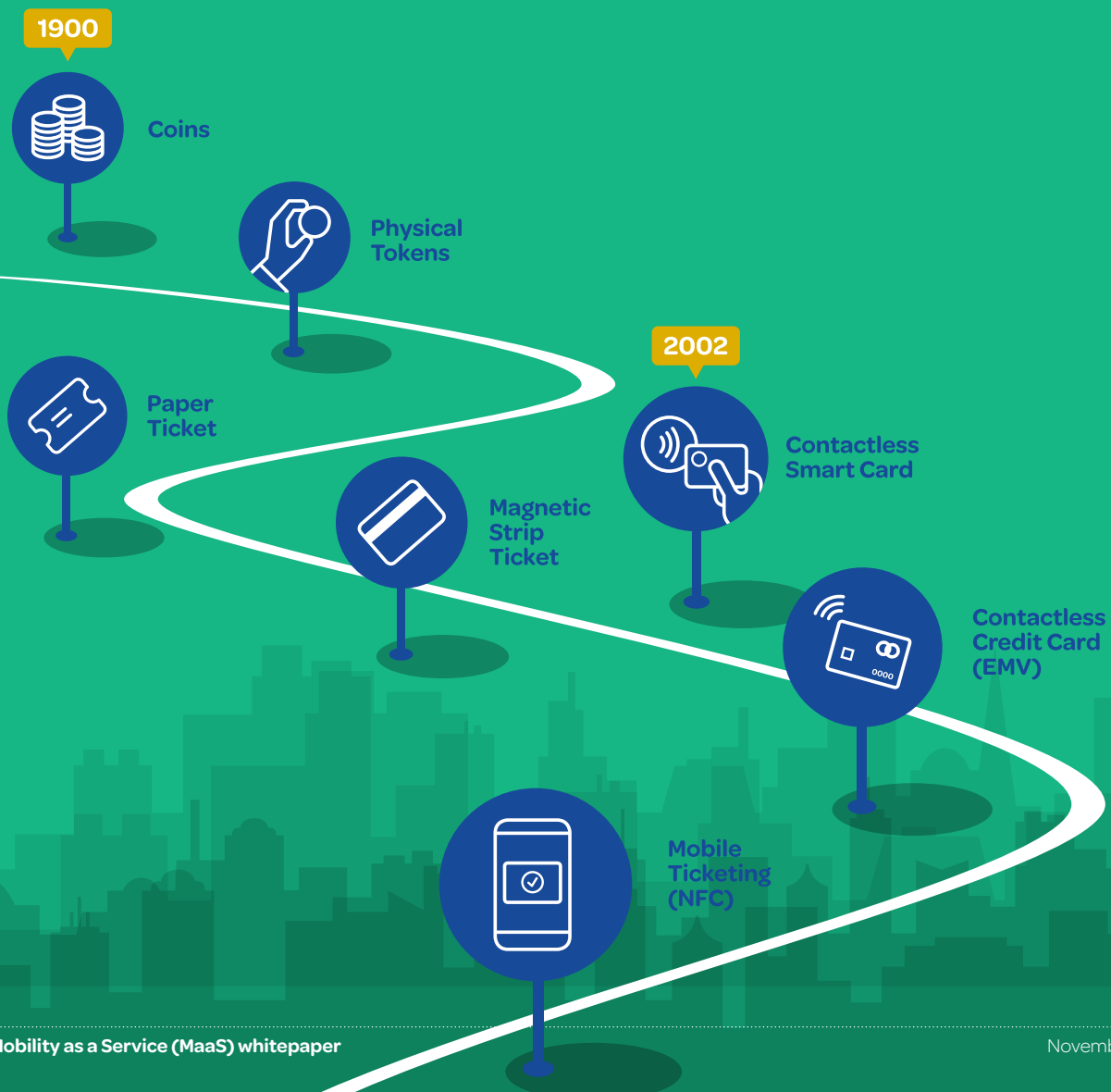
a journey in Google Maps and then buy tickets straight from a transport operator, all within the same app, providing there is integration with a digital payment service. In July 2019, Google also announced updates that incorporate live traffic delays for buses and crowd level indications²⁵, so passengers can not only search and buy for tickets, they can choose a different route if their bus is late or is too crowded.

While the Rail Delivery Group reviews rail fares in the UK, passengers may increasingly turn to split ticketing apps to find the best available fares. In this interim period, mobile ticketing solutions could allow for the storage of multiple train tickets on one smartphone, reducing the need to print several paper tickets and creating an easier, simpler journey for the passenger.

In the next decade there will be a significant shift towards electric and even autonomous vehicles, as the public demand greener travel and increased mobility. Route planning apps will be able to give passengers the option of driving to a transport hub for the first mile of their journey before taking public transport, reducing congestion in inner cities. We also predict that soon car users will be able to plan their route, pay for parking,

electric car charging, and buy public transport tickets using just one app.

Smartphones may be the device of choice for now, but it's likely that wearables could also begin to be used for route planning, ticket purchase and travel. It's not hard to imagine a watch or other device being able to register your travel movements and provide you with the best possible travel fare available that day.



Mobile ticketing is critical to bridge the gap between where we are today, and a fully integrated MaaS system in the UK.

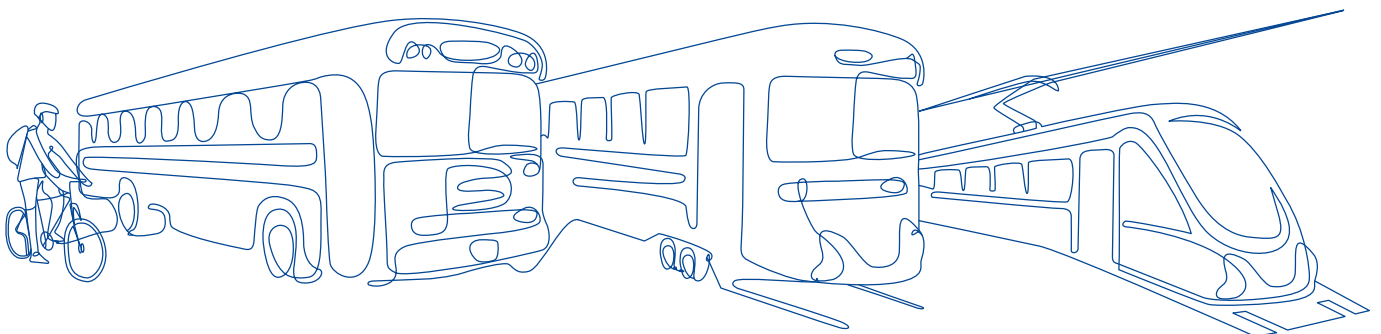
Only once there is a commonly accepted and widely used digital interface, adaptable to all forms of public transport including and connecting bus, rail, car, taxi and bike, will operators be able to deliver mobility in a fully connected state.

The provision of smart transport services is a core function of strategic importance for cities and regions in the UK, as we grapple with ever-increasing urban congestion and a growing consciousness of our rising carbon footprint. Consequently, it is becoming increasingly necessary for the government and operators to invest in the technology that will make integrated services a reality and meet the expectations of the tech-savvy passenger.

The key to seeing concrete progress in MaaS is collaboration between operators of different networks and modes of transport to allow for fluid travel across and between cities using mobile ticketing. Passengers want to have the option of buying and storing their tickets on their smartphones.

It is crucial that operators adopt the technology to meet this demand.

As ticket fulfilment is still the missing link in MaaS, now is the time for the transport industry to work together with major technology companies to explore how their journey planning and payment solutions can integrate with ticket purchasing. Once a connection between operators and technology providers is established, passengers will benefit from an up to date and easy-to-use transport system across the UK and beyond.



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