About the GSMA

The GSMA represents the interests of mobile operators worldwide. Spanning more than 220 countries, the GSMA unites nearly 800 of the world's mobile operators with 250 companies in the broader mobile ecosystem, including handset and device makers, software companies, equipment providers and Internet companies, as well as organisations in industry sectors such as financial services, healthcare, media, transport and utilities. The GSMA also produces industry-leading events such as Mobile World Congress and Mobile Asia Expo.

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Digital Commerce

White Paper:

The Value of Mobile Commerce in Transport

FEBRUARY 2014

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1.

Executive Summary

Context

Mobile technologies and services can transform many aspects of the daily lives of travelling consumers. For example, the mobile medium can be used to:

- send personalised information about delays on a commuter's route to work (contextually relevant information)
- enable the consumer to buy a new travel ticket on the go, or a coffee at the station
- notify the consumer of offers when they are close to a coffee shop on the way to work
- send a joint special offer from the transport operator and the local cinema for a free snack when watching the new blockbuster after work – to incentivise customers to travel during off peak times (cross-industry revenues/ service innovation).

This convergence of retail, couponing, loyalty and transport, in combination with contactless technology and location-based services, can be harnessed for the benefit of travellers, a wide range of direct service providers, and the broader ecosystem. Our *Mobile Commerce in Retail: Loyalty and Couponing* White Paper shows how a wallet can be a key integrator of new services, bringing the citizen a rich and compelling experience over a secure channel.

Focus of this paper

Within that broader context, the focus of this paper is on ground transport – trains, buses, trams and bicycle-sharing schemes. It shows the value of mobile services using both mobile networks and short-range technologies, such as Near Field Communication (NFC) that enable door-to-door journey planning within the broader mobile commerce ecosystem. In this process of value creation, mobile ticketing can be a key differentiator for ground transport.

Value of mobile commerce in transport

The mobile device is a key enabler for a new customer experience in public transport. It enables a direct communication channel between the transport operator and the individual customer. This link enables the transport operator to gather information about customers' travel preferences and habits. Having this information enables the transport operator to deliver a range of personalised services that are relevant to the specific situation of its customers. These personalised services can be based on tickets the customers have bought or are considering buying. This results in a more attractive transport service for customers, and hence greater use of public transport. A highly-utilised public transport system could reduce private car usage and congestion, generating environmental and economic benefits for society as a whole.

VALUE OF MOBILE COMMERCE IN TRANSPORT

	Convenience/Time Savings	Information	Financial Savings/Gains
Traveller	• Door-to-door planning, ticketing and ancillary services • Buy a ticket anywhere, anytime • Could charge a ticket to mobile bill (subject to regulation)	• Continuously updated and personalised travel options • Check remaining credit • Information on surrounding attractions and amenities	• In the event of phone loss, digital ticket can be restored • Easy access to offers and vouchers related to journey • Easily select best ticket for journey
Transport Operator	• Faster throughput • Ability to contact customers quickly and easily • Flexibility to vary pricing/ ticket types	• Real-time data on ticket and network usage • Better understanding of passengers' needs • Potential for real-time feedback from customer	• More efficient / effective inspection leading to reduced fraud • Lower distribution costs for tickets and information • Less cash handling • Commission on travel-related offers/advertising from partners
Mobile Operator	• Help establish market for mobile commerce services	• Better understanding of customers	• Revenue from transport operator • Greater usage of mobile networks • Increased demand for mobile NFC devices

Figure 01

The potential benefits of mobile commerce in transport for mobile network operator (MNOs) and transport operators, governments and consumers fall into the following categories:

- Convenience and time savings
- Information
- Financial savings and gains.

Next steps for the mobile and transport sectors

This paper proposes several ways in which transport operators and mobile operators can pursue this opportunity. Potential next steps include:

- Collaborate to create innovative services across industries, ensuring efficient and simple service provision and operation via an integrated mobile wallet. This requires MNOs to adopt consistent business-to-business interfaces and business processes
- Ensure compatibility of standards and certification across the mobile and transport value chains (including compatibility with the existing validation infrastructure)
- Support multiple ticket types on a single device, and develop door-to-door integrated services using the mobile medium as a key enabler
- Join up planning, ticketing and local commerce information, particularly for journeys that go beyond a particular city or region.

2.

Introduction

On an increasingly crowded and rapidly urbanising planet, public transport plays a critical role in hundreds of millions of individuals' daily lives. Yet the ongoing strain on national and local government finances means most public transport networks are starved of funding, even though greater usage would yield significant environmental and financial benefits.

Against this backdrop, recent advances in mobile technologies and services could be harnessed to improve the attractiveness and efficiency of public transport systems. Importantly, for passengers, wireless networks can significantly reduce the friction involved in planning a journey, paying for and receiving tickets and timely information. A combination of mobile networks and short-range contactless technologies, such as Near Field Communications (NFC), could make it much easier for both commuters and occasional travellers to use trains, buses, trams, ferries and bike-sharing programmes rather than their private car.

Aimed at both MNOs and transport operators, this paper explores the value of using mobile technologies and services to enhance public transport. It considers how mobile technologies and services could transform passenger journeys, the value created and received, potential business models, the technology landscape and the roadmap to commercial deployment. Finally, it recommends some next steps for both the mobile and transport industries.

The focus of this document is public transport (although many ideas are also applicable to air travel, particularly the so called 'first and last mile' to and from the airport).

By exploring the value proposition of mobile technologies and services in transport in some depth, this paper builds on the GSMA's Transport White Paper, published in 2012, which provided a broad overview of the opportunity.

Deployments to date

As at December 2013, scores of transport operators around the world have either trialled or are trialling the use of mobile technologies and services to enhance the passenger experience.

In some parts of developed Asia, such as Japan and South Korea, mobile handsets are already widely used to purchase and validate tickets using NFC. Similar services are now being deployed in parts of Europe and the Americas. See section 6 for case studies outlining actual deployments. Figure 2 infographic shows the scale and growth of pilots and deployments.

The adoption of mobile technologies and services by the transport sector is being driven by two major trends. Firstly, consumers increasingly rely on smartphones to manage their daily lives. The use of SMS and QR codes is now common in the transport industry. In developed markets, in particular, consumers have become accustomed to using social networks, dedicated apps and mobile web sites to quickly access information and make purchases. Increasingly, when we need to complete a task, we pull out our handset. As a result, both commuters and occasional passengers now expect to be able to use their smartphones to interact with public transit systems.

Secondly, many transport operators are under pressure from transport authorities to cut costs while at the same time making their services easier to use and more appealing for passengers, encouraging modal switching away from the private car. This pressure reflects policy makers' desire to reduce both congestion on roads and the impact of private cars on the environment. At the same time, transport operators are typically required to keep ticket prices down to a level where public transport is affordable for the vast majority of the population. This paper explores how mobile technologies and services can help transport operators fulfill these often conflicting objectives.

Figure 02: The global scale and growth of mobile commerce transport pilots and deployments Infographic

3.

The Transformed Journey

In this section, we consider the potential impact of mobile NFC technologies and services on the end-to-end experience of an occasional traveller and two different kinds of commuter. It highlights how mobile NFC services can enhance each step of the customer journey from planning through to travel, arrival and after-care. In Italics, we have highlighted the enablers behind each step of the passenger experience.

This section highlights how mobile NFC technologies can be used to make journey planning easier and the travel experience richer, as well as making it straightforward to buy a ticket or a 'right to travel'. Consumers have more relevant information (tailored to the individual, location, context, ticket, and so on) at their fingertips, enabling them to optimise their journeys in new ways.

Example customer journey for an occasional traveller

Journey planning and buying a ticket

A father and son living in a small town decide to go on a shopping trip in a city 40 km away. The father opens the journey planning mobile app on his smartphone. The phone locates his current position and he types in the retail outlet they are aiming to reach. The app tells him the next train leaves in 30 minutes, so he clicks the 'buy tickets' button next to the journey schedule. The app offers him one adult and one child return tickets. He clicks "confirm" and his mobile wallet opens and asks him to key in his four-digit security code. Once he has done so, the tickets appear in his wallet. With the ticket sale completed, the journey planner offers him links to directions, real-time travel updates, parking reservations and news of what's on in the city they are heading for.

As the father and son have booked this journey before, the transport app automatically offers him one adult and one child ticket. When he clicks 'confirm', the transport app sends the details of the transaction to the mobile wallet, triggering it to open and display the amount due and his preferred method of payment. When he keys in the four-digit security code, the mobile wallet connects to the appropriate payment gateway to authorise the transaction. Once authorised, the gateway notifies the transport operator's server that it can send the father the tickets.

Outward journey

The father and son walk down to the station and board the train. Soon a ticket inspector comes into the carriage. The father taps his handset against the inspector's terminal, which signals that he has one valid adult ticket and one valid child ticket.

The father's SIM card and handset are NFC-enabled, so they can interact with an NFC terminal. The inspector's NFC terminal is authorised to access the transport applet on the father's SIM card, enabling it to verify the valid tickets.

As they approach the city, the father's phone buzzes with an alert from the transport app. It tells him there is a music festival taking place in the city park and also offers him a voucher for free child entry into the city's aquarium. He clicks on the link and the voucher arrives in his wallet.

The father has authorised the transport app to send him specific information and offers that are relevant to families using location data captured by the mobile network. Once the transport app registers that he is in the proximity of the city, it sends him information and offers that are tagged as relevant.

Return journey

After a busy four hours, the father and son decide to head home. As they begin walking back towards the station, the father gets an alert from his transport app telling him that the next train to their town leaves in eight minutes. They quicken their pace and catch the train.

Using information from the mobile network, the transport app registers that the father is now walking in the direction of the station, prompting it to send him the alert about the next train home.

As they ride home, the transport app buzzes again. It offers the father a voucher for a free cup of coffee from the buffet car, if he will complete a short survey. He answers the questions and the voucher arrives in his wallet, along with a message asking whether he would like to use it on this journey. He clicks "yes".

They go down to the buffet car and the father orders a coffee, two muffins and a lemonade for his son. He taps his handset against a point of sale terminal, which then shows the new balance and he taps his phone again to confirm the transaction. The voucher disappears from the father's wallet and is replaced by a digital receipt, which tells him the train operator will be increasing the frequency of this service next month.

The transport app uses information from the mobile network to register that the father is on the train and send him the invitation to complete the survey. When the father chooses to activate the voucher, the mobile wallet readies it for use. When he comes to pay, the NFC point of sale terminal registers the voucher, adjusts the balance and invites him to tap the terminal again. As it is a small transaction, he doesn't need to enter a security code. The father taps the phone again, prompting the voucher to disappear from his wallet, which informs the transport app of the transaction, prompting the app to request a digital receipt from the transport operator's app server.

Example customer journey for a commuter using a season ticket

At home

At the beginning of the month, a commuter opens the transport app on her smartphone to renew her season ticket. She clicks renew, her mobile wallet opens and she keys in her four-digit security code. The season ticket in her wallet is updated to show a new expiry date.

As the commuter buys the same season ticket each month, the transport app offers her a simple renew option. When she clicks on the button, the transport app sends the details of the transaction to the mobile wallet, triggering it to open and display the amount due and the commuter's preferred method of payment. When she keys in the four-digit security code, the mobile wallet connects to the appropriate payment gateway to authorise the transaction. Once authorised, the gateway notifies the transport operator's server that it can update her season ticket.

At the station

When she arrives at her local station, she taps her handset against the ticket gate, which then opens, allowing her to walk through. She receives a notification (via transport app or mobile wallet) that her season ticket entitles her to the use of a new lounge area at the station, along with instructions on how to find it. She taps her handset against the lounge door and it opens to let her in.

The commuter's SIM card and handset are NFC-enabled, so they can interact with NFC terminals. Both the NFC readers on the station gate and the lounge door are authorised to access the transport applet on her SIM card, enabling them to verify the valid season ticket. The transport app registers the ticket gate validation, prompting it to alert her to the new lounge facility.

On the metro

Just before the commuter boards the metro, her transport app buzzes to warn her that the station where she usually alights is closed due to a security alert. It advises her to get off one stop early and offers her walking directions or a voucher to use the city bike hire system. She clicks on the voucher, which then arrives in her wallet. The wallet asks her if she would like to use the voucher today and she clicks "yes".

As the transport app knows which stations the commuter uses on a regular basis, it sends her the alert about the station closure and the alternative means of transport. When she clicks on the voucher link, a digital image of the cycle voucher will appear in the wallet, which then asks her if she plans to use it today. When she clicks "yes", the wallet readies the voucher for use.

The final leg

The commuter gets off the metro one stop early and taps her handset against a reader to open the exit gate. She finds the hire bike station and taps her phone against the reader to release one of the bikes. The voucher is removed from her wallet.

The NFC reader on the bike station is authorised to access the transport applet on her SIM card, enabling it to verify the voucher and then remove it from her wallet.

Example: Customer journey for a commuter using mobile top-up in a transport account

Catching the bus

On his way to the bus stop, a commuter in an African city (emerging market) opens the city transport app on his mobile phone to check the balance on his transport account. The app shows he has enough credit for one more bus journey and also flags that his next bus will arrive in five minutes. Once on the bus, the commuter taps his handset against a reader to validate his journey.

The commuter has given the transport city app permission to use location information captured by his mobile network. The app uses this data to determine which bus stop he is heading to. It then checks with the transport operator's app server when the next bus, which has its location tracked by the mobile network, is due to arrive. As the commuter's SIM card and handset are NFC-enabled, they can interact with the on-board NFC reader, which checks that there is enough credit on the transport applet on the commuter's SIM card. It then deducts the necessary credit and validates the applet for travel.

On board the bus

While the commuter is sitting on the bus, his transport app buzzes with a message asking him if he would like to top up his credit. He doesn't have a debit or credit card, but the app asks him whether he would like to charge the top-up to his mobile phone bill. He clicks yes, his mobile wallet opens and he confirms the transaction by entering a security code. The wallet displays the new prepaid balance on his mobile phone account and his transport app buzzes with a message showing the new balance on his transport account.

To give the commuter time to find a seat, the transport app waits a few minutes before asking him if he would like to top up his credit via his mobile subscription[1]. The commuter has registered his mobile phone account as his preferred payment method with the transport app. When he clicks yes, the transport app sends the details of the transaction to the mobile wallet, triggering it to open and display the amount due and his preferred method of payment – the mobile bill. When he keys in the four-digit security code, the mobile wallet sends a request to the mobile phone operator's billing system, which authorises the transaction, notifying the transport app server.

1. Note, this approach depends on local regulation allowing mobile phone accounts to be used to make purchase physical goods and services, as well as digital goods.

4.

Value Created and Received

We consider how each entity of the transport value chain can benefit from the use of mobile technologies and services, including NFC, to provide passengers with information and ticketing.

This chapter defines the different kinds of incremental value that mobile technologies can create for consumers, transport operators, MNOs and public transport authorities. It should be noted however that the value created by mobile NFC, in combination with other technologies, could go well beyond localised incremental benefits as travelling can become smarter. New service providers and the information they have at hand can offer more intelligent travel solutions to customers. Moreover, these new services can go well beyond transport, encompassing other touch-points in the consumer's journey, such as shopping, leisure activities, public services, and work. The potential for innovation is enormous.

Figure 3 summarises these potential benefits, which are then explained further, across four different categories:

- **Time savings**, for example, due to the fact that tickets can be bought on the go without queuing
- **Information availability** – this benefit is relevant not only for customers who are more likely to use public transport when the relevant information is at hand, but also for transport operators and mobile operators. Mobile operators and transport operators are in a better position to provide tailored, and therefore more valuable, services for customers if they can be based on better information about customers, their habits and journeys
- **Financial savings** are an important consideration for transport operators, for example, arising from fraud reduction or the cheaper distribution of tickets
- **Financial gains:** New and innovative services can create new revenue streams.

VALUE OF MOBILE COMMERCE IN TRANSPORT (EXPANDED)

	Convenience/time savings	Information	Financial gains	Financial savings
Commuter	• Renew a ticket anywhere, anytime • Less queuing • Works with flat battery • Intermodal opportunities	• Real-time congestion updates and alternative routing • Can check remaining credit	• Flexible pricing linked to the time of travel	• In the event of phone loss, season ticket can be restored • Easy access to offers and vouchers related to journey
Occasional Traveller	• Door-to-door planning, ticketing and ancillary services • Buy a ticket anywhere, anytime • Doesn't need cash • Works with flat battery • Could charge a ticket to mobile bill (subject to regulation) • All tickets stored in one place	• Continuously updated and personalised travel planner • Check remaining credit • Information on surrounding attractions and amenities	• Flexible pricing linked to the time of travel	• In the event of phone loss, digital ticket can be restored • Easy access to offers and vouchers related to journey • Easily select best ticket for journey
Local/national government	• Opportunity to make transport systems more interoperable • Increase attractiveness of public transport	• Modal switching to lower carbon modes of travel • New channel for public service information	• Reduced congestion, leading to more economic activity	• Better data, leading to more efficient use of transport networks • Environmental benefits
Transport operator	• Faster throughput • Ability to contact customers quickly and easily • Simplification of processes • Flexibility to vary pricing/ ticket types	• Real-time data on ticket and network usage • Better understanding of passengers' needs • Potential for real-time feedback	• Better informed and more satisfied passengers, leading to greater usage • Easier to buy/change tickets (greater usage) • Image improved (greater usage) • Commission on travel-related offers/ advertising from partners.	• More efficient / effective inspection leading to less fraud • Lower distribution costs for tickets and information • Less cash handling
MNO	• Help establish market for mobile commerce services	• Better understanding of customers	• Revenue from transport operator • Greater usage of mobile networks • Upselling of related products and services	• Increased demand for mobile NFC handsets and SIM Cards

Figure 03

The question of how these benefits can be achieved is discussed subsequently in chapter 4.

The potential for value creation in each of these categories will depend on the country, the specific deployment and the players involved. For example, the impact of a mobile NFC ticketing implementation will differ depending on whether a transport network is migrating from magnetic stripe paper tickets or contactless cards. If the existing system is based on paper tickets, the value created by mobile NFC may be especially high, as consumers will now be able to purchase tickets on the go, saving them time. Mobile NFC can also increase the passenger information available to the transport operator and, therefore, lead to more tailored services throughout the customer's journey.

If a transport network is already using contactless cards, then the value provided by mobile NFC will be more focused on new possibilities to offer integrated journey planning, real-time information, payment and ticketing on the same device. Mobile NFC services can also be used to provide consumers with combined offers with adjacent industries, cutting distribution costs.

Benefits for commuters

For commuters, the primary reasons for using mobile NFC and mobile data services are convenience and access to information. Although commuters could also derive some financial benefits, the potential to save time and easily switch travel modes is likely to be the main motivator for adoption.

Convenience

A transport operator could enable a commuter to renew a digital season ticket, top up a closed loop account or purchase a carnet (book of 5 or 10 tickets) at any time and from anywhere. The ticket, credit or carnet could be delivered over-the-air to be stored securely on the SIM card. That would enable the commuter to avoid queues at stations and bus terminals to renew season tickets or top up credit.

Moreover, the use of NFC for validation can be more convenient for a commuter than QR codes or barcodes. A NFC terminal can validate a NFC-enabled ticket even if the host phone is turned off or has a flat battery. This is not the case with a ticket that employs a QR or barcode. Similarly, a ticket inspector can validate a NFC ticket with a single tap, rather than having to hold the passenger's phone and scan a QR or barcode.

Information

Journey planning apps can provide information across all modes of transport, as well as enabling the consumer to purchase the tickets for a chosen journey and have them downloaded to their mobile device. A transport operator can also use a mobile app to deliver personalised real-time congestion updates and alternative routing information to commuters based on the tickets they have purchased. As passengers typically have their mobile phone with them, it can act as a continuous communication channel between the transport operator and its customers. The transport operator could, for example, keep commuters updated on the projected arrival time of their bus or train.

A commuter can also check the details of a season ticket or carnet stored on their handset at any time. They can see the expiry date, which routes the ticket is valid for and, in the case of a prepaid system or carnet, how much credit they have left. The transport operator could also enable the commuter to see the journeys they have taken in the past, enabling them to claim back expenses from an employer.

NFC tags can also be used to provide information. For example, they can be placed at bus stops to provide information about bus times, events, nearby retail shops, and so on. Moreover, when a consumer has many tickets stored on their mobile device, a NFC tag can help to bring out the ticket to be used, for example on the approach to a bus stop, station, or event.

Financial savings

In the event of phone loss, a NFC-enabled ticket can be restored over the air. A transport operator can also use a mobile app to provide commuters buying season tickets with loyalty rewards, targeted offers and vouchers. A mobile app can enable a commuter to see all the options to make a journey from door to door alongside each other, and make an informed choice based on the financial and environmental implications of each mode of transport.

The potential to save time and easily switch travel modes is likely to be the main motivator for adoption.

Benefits for the occasional traveller

Again, the primary motivation for occasional travellers to use mobile NFC tickets and mobile data services is convenience and access to information. As they are generally less familiar with their route than commuters, occasional travellers should benefit even more from having the journey plan, transport ticketing and related information on their mobile handset.

Convenience

An individual can use their mobile handset to buy a digital ticket at any time, from anywhere, supporting spontaneous travel decisions. For example, if a couple driving to the cinema is stuck in a traffic jam, they could check the train times on their phone and, if the times work, buy a ticket while they are parking the car. Rather than having to find a ticket machine and insert cash in the right currency, an occasional traveller could use their handset to buy a ticket remotely using a stored debit or credit card or through their mobile account.

Moreover, an occasional traveller is less likely to forget or mislay a ticket stored on their mobile handset. An MNO could provide a wallet app that acts as a convenient place to store tickets from multiple transport operators and event organisers, making life simpler for tourists with complex travel itineraries. Finally, even if the traveller's phone battery is flat, an NFC terminal can still validate an NFC-enabled ticket stored on the handset, which is not the case with a digital ticket that uses a QR or barcode.

Information

A mobile device can enable an occasional traveller to become much better informed about their travel options. If the passenger has bought a digital ticket, the transport operator could use an app to provide the passenger with real-time information about their journey and attractions and amenities at their destination – all in the passenger's preferred language. The transport operator could even use a map or navigation service to guide an occasional traveller to the correct platform in a busy station or bus terminus.

Moreover, the transport app could provide real-time information on expected arrival times, number of stops remaining and alternative routes. It could also enable the passenger to check the validity of their ticket.

Financial savings

By making the available transport options clear, a mobile device can save the occasional traveller money. For example, an individual standing in a taxi queue could use their mobile device to check whether there is an imminent bus to their destination and where it leaves from. Similarly, a mobile app in the traveller's language can make it easier for the passenger to select and buy the best transit ticket. The transport operator could even offer a 'cheapest ticket' guarantee, whereby it uses NFC terminals to track the journeys the passenger makes and then charges them for the appropriate ticket at the end of the day.

Moreover, if the traveller loses their phone, their digital tickets can be restored over the air to a new handset. Finally, a transport operator or MNO could deploy a mobile app to provide the traveller with relevant offers and vouchers that could save them money on hotels, restaurants, attractions and activities.

Occasional travellers should benefit from having the journey plan, transport ticketing and related information on their mobile handset.

Benefits for local and national governments

For governments using mobile NFC in transport can offer a wide range of benefits.

Time savings

The use of mobile NFC transport ticketing could reduce the need to make transport networks' ticketing systems fully interoperable. Implemented well, a mobile NFC ticketing and information service can mask the complexity of using multiple transport networks from the passenger. A mobile device can store tickets from multiple transport operators enabling citizens to easily move across transport networks, fulfilling governments' policy goals of making public transport easier to use and ultimately more attractive to citizens.

Information

Mobile NFC technologies and services could provide a new channel for public service information. For example, with an appropriate court order, a police force investigating an incident could use the mobile channel to send out an appeal for information to a group of commuters who regularly use a particular station at a specific time.

Financial gains

By giving both passengers and transport operators greater access to real-time information on congestion and potential congestion, mobile NFC ticketing could enable the transport networks to run more smoothly. The net result would be that people would spend less time travelling, potentially increasing their productivity and boosting economic output.

Financial savings

The widespread use of mobile NFC tickets would make it easier for transport operators and authorities to track how transport networks are being used, enabling them to allocate resources more efficiently and deploy new infrastructure where it is most needed. Moreover, mobile NFC will reduce the need to print paper tickets and produce plastic cards, while increasing usage of public transport and reducing usage of private cars. If travellers can make an informed choice at the point of service, significant environmental benefits can be achieved, which could help reduce the costs associated with mitigating climate change.

Improvements in mobile travel information could make public transport more attractive, encourage modal switching and reduce congestion.

Benefits for transport operators

Today, most transport operators know relatively little about individual passengers and how they use the transport network. Mobile NFC ticketing could change that by facilitating a two-way flow of information that could enable transport operators to build a closer, deeper relationship with passengers and better meet their needs. Mobile NFC can also yield significant cost and time savings for transport operators, while potentially increasing revenues through higher usage.

Time savings

Mobile NFC could enable some transport operators to increase passenger throughput. Although it can take slightly longer to validate a digital ticket on a mobile NFC handset than it does to validate a contactless card, NFC offers the fastest secure mobile ticketing solution and it can be quicker than magnetic stripe tickets. An NFC terminal typically takes half a second to validate a ticket stored on a SIM card on a NFC handset, which is typically faster than a holding a digital image of a QR code or barcode against a scanner.

Moreover, it can be easier for a transport operator to issue, renew, substitute or block an NFC ticket stored on a handset than to perform the equivalent processes with alternative approaches, such as a contactless card or a QR coded ticket stored on a phone. In a similar vein, the transport operator can quickly introduce new types of NFC tickets or change their tariffs in line with demand. For example, the transport operator could easily create a special NFC ticket designed for people travelling to a major sports event that only allows them to alight at a specific station (reducing congestion). Finally, a transport operator can use a mobile app to contact customers quickly and easily, enabling it to advise a passenger that their season ticket has expired, for example.

Information

A mobile NFC ticketing solution can give a transport operator detailed data on network and ticket usage, enabling it to predict where congestion might occur and where to allocate staff and other resources. Mobile NFC can also show the transport operator how individuals use its network, giving the transport operator an opportunity to provide personalised advice and information. For example, the transport operator might want to advise certain passengers of a new bus route or engineering works that could affect their journey.

A mobile app can also give passengers the opportunity to provide real-time feedback on the service. For example, they could be asked to rate the cleanliness of trains and stations or they could be asked what amenities they would like to have at their home station.

Financial gains

By making it easy to access information and buy tickets, a mobile NFC ticketing solution can drive greater usage of a transport network, increasing revenue for the transport operator. Better-informed customers are likely to have a better experience, encouraging them to use the service again and recommend it to others. Similarly, the ability to buy or amend tickets quickly and easily will encourage people to use a transport network.

More broadly, a mobile NFC solution could improve the image and reputation of the transport network, again stimulating greater usage. At the same time, a travel operator could earn revenues from brokering travel-related, targeted offers and advertising from third parties. For example, a restaurant may wish to insert an advert in a transport app used by commuters that generally alight at a certain train station.

Financial savings

A transport operator can use a mobile NFC solution to lower the cost of distributing both tickets and information. Although most transport operators will need to maintain some ticket machines and ticket kiosks for the foreseeable future, greater use of digital ticketing will reduce the need to produce plastic cards, paper tickets and information leaflets. Some transport operators may also be able to reduce the number of independent ticket distributors they use. At the same time, transport operators will have to handle less cash, reducing associated costs such as the number of trips to the bank. NFC phones can also help to lower the maintenance costs for paper ticket validators.

Mobile NFC is also less vulnerable to fraud than other mobile ticketing solutions. For example, a cancelled NFC ticket will be registered as cancelled on the passenger's handset and will be detected as such by a validator. However, a cancelled QR or barcode-based ticket is only registered on the transport operator's web server: if the validator can't connect to the server, it won't know that the ticket has been cancelled. Finally, a mobile NFC solution can save a transport operator money by automating aspects of customer service. For example, a NFC ticket could be linked to a website listing frequently asked questions in the language of the passenger.

Having real-time knowledge of travellers' needs and the ability to direct tailored information to passengers gives transport operators considerable scope for demand and resource management. Matching the number of deployed buses or carriages to demand will provide cost savings and avoid unnecessary fuel use.

A mobile NFC solution could improve the image and reputation of the transport network, again stimulating greater usage. At the same time, a travel operator could earn revenues from brokering travel-related, targeted offers and advertising from third parties.

Benefits for mobile operators

Mobile NFC could open up new revenue streams for MNOs (see next section for more details). More broadly, widespread usage of mobile NFC in the transport sector would help the technology gain traction in the retail, entertainment and hospitality sectors, opening up mobile commerce opportunities for MNOs.

Time savings

Widespread usage of mobile NFC in transport could reduce the time it takes for MNOs to build a compelling mobile commerce proposition. If consumers are using mobile NFC regularly on transport networks, they will become familiar and comfortable with the technology, paving the way for its usage in other sectors, such as retail, entertainment and hospitality.

Information

If passengers store transport tickets in a mobile wallet provided by an MNO, the operator could gain valuable insights into consumers' daily lives. With the passenger's permission, the data captured by the wallet and the resulting insights could enable the MNO to refine its existing services and create new services.

Financial gains

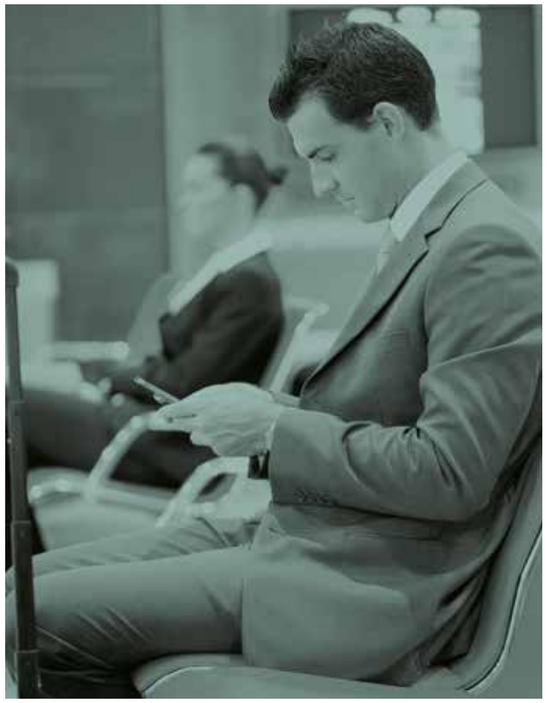
Assuming it provides sufficient value, an MNO could earn revenue from transport operators (the next section looks at this opportunity in more detail). The use of mobile NFC in transport should also lead to greater usage of mobile networks as consumers become accustomed to buying tickets online and looking up travel-related information.

Financial savings

The rollout of mobile NFC in the transport sector would increase demand among consumers for NFC-enabled handsets, SIM cards and mobile wallets. That could reduce the need for MNOs to market these devices and services, potentially saving the operator some marketing spend.

Relevance of micro-payments

From existing deployments in Asia and Russia, it appears that the ability for the customer to top-up their transport account – either at the station or 'on the go' through the mobile – is an important benefit for the transport operator and customer. Further, subject to regulatory constraints, the transport or MNO might see value in offering the customer a means to pay (for example via charge-to-mobile-bill, or offering a stored value account that is accepted by retailers). This represents an additional source of revenue (transaction fees) to the party providing the payment capability. The mobile wallet is relevant in this context, both for storing the payment cards and for providing the user with a means of making their choice of card for the transaction.



5.

Potential Business Models

Each of the entities involved in delivering mobile NFC information and ticketing services needs to have a viable business model. This section discusses the shape of the value chain and some potential business model permutations.

The business models underpinning a mobile NFC service need to take into account several inter-related factors:

- The shape of the value chain
- Potential cost and revenue trajectories
- Economies of scale
- Different MNO revenue models
- The role of tickets.

Mobile NFC in the transport sector requires new participants to enter the value chain.

The shape of value chain

The deployment of mobile NFC in the transport sector requires new actors, most notably MNOs, to enter the value chain.

Figure 4 shows the how a mobile operator fits into the value chain and the different layers of value it can add to the transport ecosystem. The MNO can contribute through the timely distribution of information, easier and more secure ticketing and payment, and value added services, such as couponing and loyalty.

HOW MOBILE COMMERCE SERVICES CAN IMPACT THE TRANSPORT VALUE CHAIN

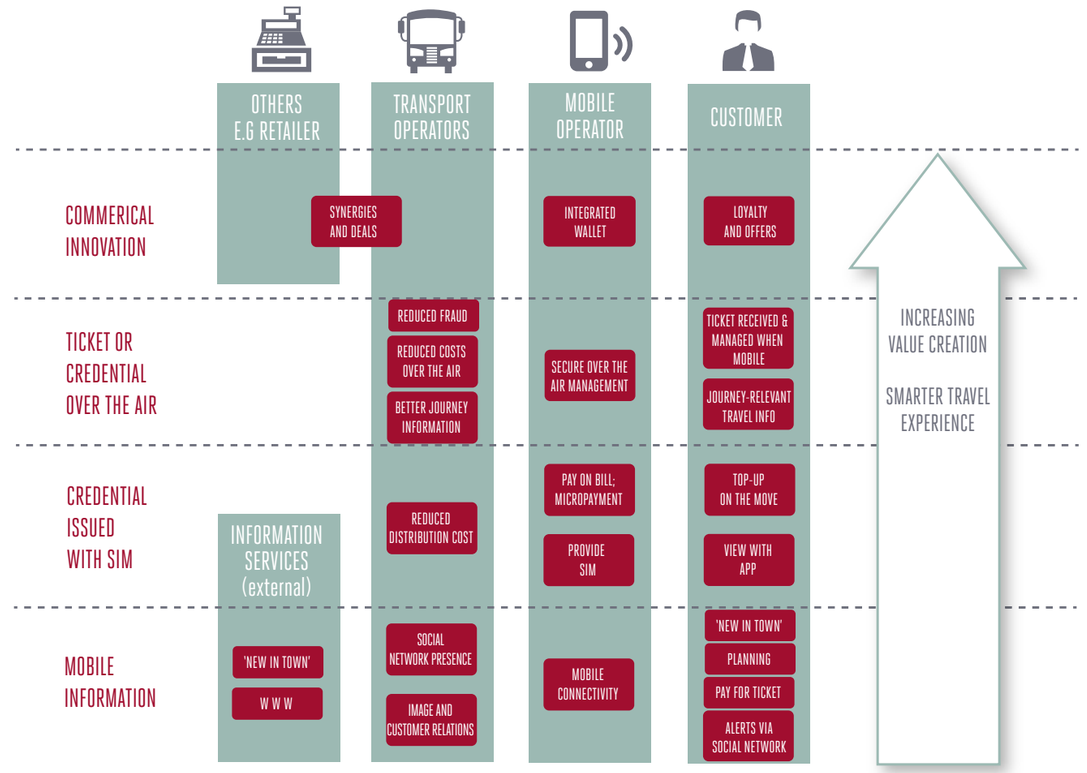


Figure 04

In Figure 4, the lowest layer highlights how mobile technologies can provide customers with valuable information to aid journey planning, find local facilities and to allow online ticket ordering. In most cases, transport operators are already using the mobile medium to provide this kind of information to passengers.

The next layer up illustrates the case of a transit credential – representing a transport account – being issued with the SIM card. As this case is reasonably straightforward to implement, it is the most commonly deployed case of mobile NFC in transport today. A transport app, linked to backend systems, enables the passenger to easily top up their transport credit

while mobile. Support for micropayments, for example via a prepaid transport account, possibly also used for retail payments, or via the existing mobile account, can influence the business case. The relevance of these use cases varies in different territories. Often this is a transitional stage, before full over-the-air management is put in place.

In the third layer ('Ticket or credential over the air'), the mobile ecosystem adds more value by enabling transport operators to issue and manage tickets or other credentials over the mobile network, and to provide related information. This scenario provides greater benefit to the transport operator, and the additional security in this case is particularly relevant for high-value tickets and accounts. Payment network cards – EMVCo cards – on mobile NFC handsets are also typically managed this way, and some transport operators plan to accept EMVCo payment cards.

Finally, the top layer ('Commercial innovation') shows, that after all the infrastructure has been developed, transport operators, adjacent industries and independent innovators can explore new opportunities for smarter travel solutions. In the retail context, this can include offers, loyalty points and vouchers. By 'adjacent industries' we mean the local economy surrounding a major travel interchange, including hotels, retail, food and parking providers. There is also scope for wider innovation incorporating private travel planning, especially car journeys and car sharing schemes. The combination of a common mobile operator wallet, multiple mobile NFC services, location-enabled information and services – and other factors – could enable the cost-effective rollout of a wide range of business initiatives and smarter transport solutions in future.

Despite the inclusion of new actors, in some markets, mobile NFC could eventually simplify and streamline the value chain in that there may be fewer parties involved in the sale and distribution of tickets and information. In this new value chain, the provision of transport tickets and information could become inextricably linked. Rather than simply issuing transport tickets, the value chain can be thought of as providing a "transport facility" that delivers a range of personalised services to passengers based on the tickets they have bought or are considering buying. However, the flow of data within the value chain needs to be carefully managed to ensure that individual consumers' privacy is not compromised and that information is only used in ways that are explicitly authorised by the subject of the personal data.

The combination of a common mobile operator wallet, multiple mobile NFC services, location-enabled information and services – and other factors – could enable the cost-effective rollout of a wide range of business initiatives and smarter transport solutions in future.

Potential cost and revenue trajectories

Political pressures mean that transport operators typically have to operate at very low margins, so a mobile NFC solution will need to be at least cost-neutral in the near term. In most cases, the initial set-up costs will need to be recouped within two to three years.

The impact of mobile NFC on ticket distribution costs will depend in part on the stance taken by local and national governments. If transport authorities insist that transport operators continue to offer manned ticket kiosks and multiple tickets machines at each train or bus station, then the impact of mobile NFC on the cost of distribution is likely to be modest. (Note, station staff often have multiple customer care and security duties in addition to selling tickets, so many transport operators won't be able to move to completely automated stations). Similarly, political considerations may also require transport operators to continue using third-party ticket and information distributors, limiting the opportunities to simplify the value chain and reduce costs.

Many transport operators focus on the opportunity to use mobile NFC to cut costs, but, as highlighted in the previous section, there are also opportunities to increase revenues. The impact of mobile NFC on the usage of specific transport networks will depend heavily on local factors, such as the spare capacity available in the system, the frequency of services, the congestion on the road network, the mix of commuters in relation to occasional travellers and the priorities of transport authorities. For example, an easy-to-use mobile transport solution could have a significant impact on the usage of public transport in cities that attract large numbers visitors and have complex public transport systems, such as London and Paris.

Although mobile technologies can provide value added services to passengers, most transport operators don't believe consumers will be willing to pay for these services. In fact, some transport operators have introduced differential pricing to persuade consumers to adopt new ticketing technologies, as Transport for London has done with its contactless Oyster card.

As each national market is different, with its own set of factors influencing the business model, multinational MNOs should bear in mind they may not be able to implement the same business model in all the markets in which they operate.

Economies of scale

The business case for mobile NFC solutions typically depends on achieving scale. The potential financial savings, in particular, rely heavily on the displacement of existing ticket and information distribution systems. For that reason, both transport operators and MNOs should recognise in their business models that most of the financial benefits will accrue in the mid-term.

In the near-term, the focus should be on a business model that encourages rapid passenger adoption and reduces the time it takes to get to a tipping point where existing ticketing and information systems can be partially displaced. For this reason, transport operators and mobile operators may wish to adopt a commercial arrangement that shares the risks and rewards. Alternatively, they may wish to agree a threshold, such as one million regular users, at which they expect scale benefits to kick in, enabling the commercial arrangements to change. Another approach is to build explicit incentives into the business model that will motivate the value chain to pursue scale.

Different mobile operator revenue models

MNOs could charge for the use of their networks and SIM cards for ticket distribution in several different ways. These include:

- One-off charge, such as a set-up fee
- Charge per use, which could be a percentage commission or flat fee
- Periodic fees, such as a set monthly fee.

MNOs, could, of course, use a combination of the above and could use a different scale of charges for different ticket classes. They might, for example, want to charge a fixed set-up fee, together with a percentage of the ticket price for each transaction. However, transport operators are likely to resist a model that requires them to pay a new set-up fee each time a passenger changes their SIM card. At the same time, the percentage commission on ticket sales may need to vary according to the type of ticket and the relative value of mobile NFC to the transport operators.

Depending on how they are regulated and their existing ticketing systems, some transport operators will make higher margins on occasional travellers, while others will make higher margins on commuters. Clearly, transport operators are likely to prefer to pay a flat fee for the distribution of high-priced tickets and a percentage commission on lower-priced tickets. (Note, in general, transport operators pay their distributors a single digit percentage of the ticket price). MNOs also need to be sensitive to the fact that transport operators can already use the Internet to distribute digital tickets or tickets that passengers can print out, albeit without the ease-of-use, security and anti-fraud advantages offered by an NFC and SIM-based solution.

Given the scale effects discussed above, the size of the operator's charges could be linked to the number of users. The charges would also reflect the value added services provided by the MNO. For example, if the MNO is responsible for customer service and support, then the commission fees on ticket sales may be higher – which would be justified also by the secure SIM and distribution channel the mobile operator provides. A MNO may also ask for a higher percentage if the consumer charges the cost of the ticket to their mobile phone bill, subject to local regulations. In some cases, the MNO may also earn some revenue if a passenger completes a transaction using a payment card from a bank associated with the MNO.

Finally, there may also be scope to open up new revenue streams through the provision of new services that enhance the transport proposition. For example, the MNO could become a full-function distributor for the transport operator's services, offering a full range of planning and ticketing services to customers. That would need access to the transport operators' information, such as tariffs and timetables, in a similar way to other established distributors. As another example, the MNO could support a transport operator's loyalty programme or the provision of coupons and vouchers. The GSMA's *Mobile Commerce in Retail: Loyalty and Couponing* White Paper explores this topic further.

The role of tickets

Some transport operators are aiming to reduce their dependence on tickets, and use EMVCo payment cards in their place, particularly to serve occasional travellers. The EMVCo card could effectively validate the passenger's right to travel. However, this approach requires significant initial investment, and it needs careful risk assessment to manage the possibility of non-payment due to a lack of funds, in a situation where an online check cannot be made quickly enough. This approach is more attractive in cities with a high volume of occasional travellers or high single ticket sales.

However, some transport authorities and governments are likely to resist a wholesale shift to this model as it requires passengers to have a bank account and either a physical or virtual contactless payment card. Further, this model does not allow a reduced-rate subscription for students, retired citizens and other concessionary categories, unless additional intermediate processing steps are introduced into the model. For this reason the EMVCo card will, in many cases, exist in parallel with established ticketing methods.

There may also be scope to open up new revenue streams through the provision of new services that enhance the transport proposition.

6.

Real World Practicalities

In this section, we consider the mobile NFC technology landscape and the related business implications for the transport sector. We then highlight the practical challenges that need to be overcome to enable the transport industry to realise the full potential of mobile NFC.

The technology landscape and business implications

The secure element

This paper envisages that many transport operators will use the SIM card (also known as the Universal Integrated Circuit Card or UICC) as the secure element inside the mobile device on which to store ticket information. The SIM card makes use of MNOs' existing secure provisioning and management infrastructure. Figure 5 shows how the SIM card can be managed via a separate secure channel using the mobile operator's "over-the-air" infrastructure. Other secure elements are available, although they are managed through other ecosystem participants, rather than MNOs.

The secure element could be issued with a pre-defined secure domain for transport applications or the secure domain could be established dynamically after the secure element is already in use. From the consumer experience perspective, it is important that a transport operator's applet can be installed quickly on to the secure element.

A UICC CARD CAN BE PROVISIONED AND UPDATED VIA A DISTINCT AND SECURE CONNECTION

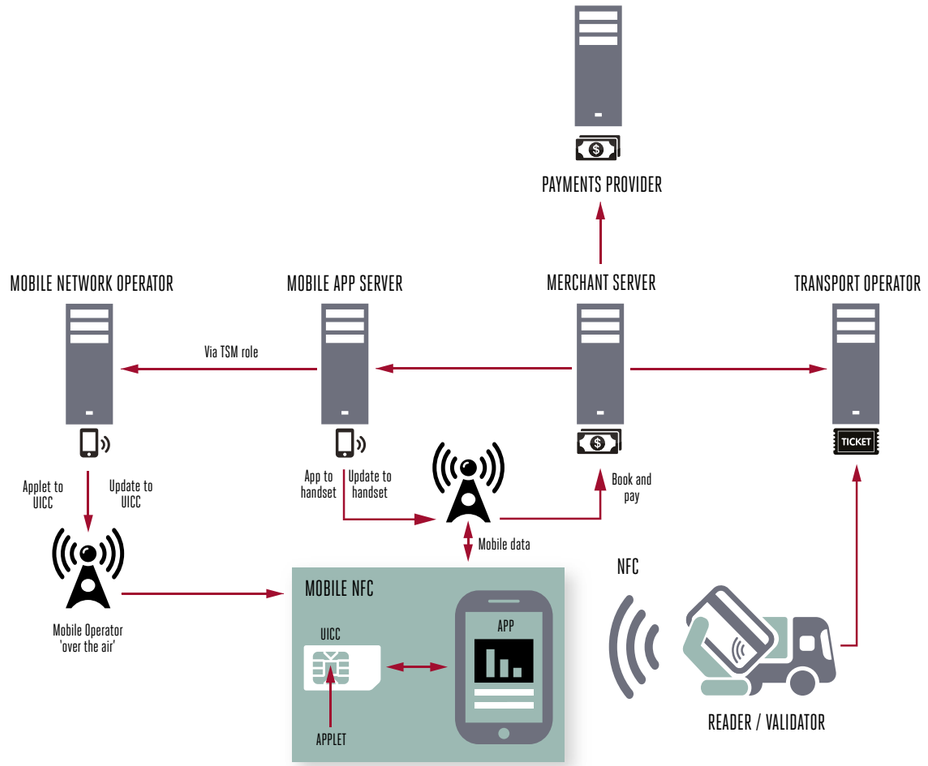


Figure 05

Trusted service managers

When a secure element is used to facilitate a mobile service, trusted service managers (TSMs) typically act as mediators between the service provider and the MNO in cases where dynamic over-the-air management is required. The transport operator's TSM would issue and manage the secure ticketing application, which the MNO's TSM then transfers over-the-air to the secure element. The TSM should be able to manage the entire life cycle of the transport applet and tickets, ideally using the current procedures already used by the transport operators. Ideally, a TSM should be able to facilitate the smooth transfer of a consumer's transport applet and travel tickets from one MNO's SIM to another operator's SIM, if the consumer switches MNO.

Smart ticket types

The transport industry uses several different smart ticketing technologies to enable contactless ticketing. Although city transit is likely to remain a heterogeneous environment, with different cities using different smart ticketing types, broader acceptance of EMV cards at transport gates should make it easier for visitors and tourists to use their mobile handsets to pay for travel on these transport systems. Smart ticket interoperability is likely to be more important in the long distance rail network, where a passenger may wish to travel across the networks of several different transport operators. In this case, a mobile handset could enable multiple ticketing technologies to co-exist on a secure element and be accessed through a mobile wallet, making life simpler for the traveller. At the same time, the transport industry needs to continue its efforts to increase interoperability through initiatives such as the Smart Ticketing Alliance.

The following are the main ticketing technologies relevant to mobile NFC solutions for transport:

MIFARE® – A proprietary electronic ticketing protocol owned by semiconductor company NXP, MIFARE® is running in the infrastructure of 650 cities around the world. NXP's MIFARE4Mobile® architecture allows over-the-air management and operation of MIFARE® resources within a mobile handset and its secure element. Essentially, it links MIFARE® technology with the world of mobile devices and their remote and local management structures. The GSMA is working with NXP and the Mobile World Capital Barcelona Foundation to make it easier for public administrations, transport operators, system integrators, reader and card manufacturers, and other ecosystem players to access NFC technology.

Calypso – The Calypso electronic ticketing standard has been deployed in 23 countries, including Belgium, Italy, France, Latvia, Portugal, Canada, Mexico, Morocco and Israel, and more than 110 cities. More than 130 million contactless cards have been deployed and there are more than 400,000 terminals in service. Calypso applications, for example in France, are local in that the public authority has the key and there is no interoperability between these local applications. However, the forthcoming ABC – Application Billetique Commune – ticketing application is designed to enable consumers to buy tickets anywhere in France for occasional travel with the possibility for inter-regional travel. Toulouse is likely to be the first city to adopt ABC.

CIPURSE – Developed by a consortium of companies, OSPT, CIPURSE is designed to be vendor-independent (all card suppliers can attain CIPURSE certification for their products). Founded by technology companies Giesecke & Devrient, Infineon Technologies, INSIDE Secure and Oberthur Technologies, OSPT Alliance membership is open to transit operators, solution vendors, government agencies, MNOs and other stakeholders in the transit ecosystem.

Felica – Created by Sony and MNO NTT Docomo, Felica has been deployed in Japan, Bangladesh (SPASS Card), Thailand, Taiwan and Hong Kong (Octopus).

Generic Ticketing Applet – Some countries have deployed one of several standard interfaces for implementing interoperable electronic fare management systems, such as those in Germany (where approximately five million VDV Core Application contactless cards are in use) and the UK, (where approximately 12 million ITSO cards are in use).

The mobile handset could enable multiple ticketing technologies to co-exist on a secure element and be accessed through a mobile wallet, making life simpler for the traveller.

The role of the mobile wallet

As individual consumers interact with many different merchants and brands, they need a straightforward and consistent approach to organising digital vouchers, loyalty programmes, payment cards, tickets and other items. The individual also needs some way to set their preferences with respect to how their personal data is used, how many notifications and offers they receive and from whom. MNOs are developing and deploying wallets, a specialised mobile app running on the consumer's handset, to meet that need.

In relation to transport tickets, the wallet typically allows the user to:

- Manage multiple tickets from multiple transport operators
- View unused tickets or remaining credit, and a short history of transactions
- Top-up an account balance or buy tickets using a preferred payment method, such as selecting a card from the wallet.

The mobile wallet can act as an interface enabling the user to select which virtual card will be used to make a payment or provide authentication. On a plastic card, which has no interface, it is the NFC reader that selects the applet. A wallet gives the user the opportunity to make the selection in advance, or to set priorities to constrain the NFC reader's choice. It can also act as a gateway into the transport operator's app. For example, the consumer might be able to open the transport app by clicking on a digital receipt stored in the wallet.

Mobile wallets could be configured to automatically prioritise an applet appropriate to the location the handset is in. However, the wallet design requires a careful balance between giving the user too many control mechanisms, and not enough.

Note, transport operators will want different MNOs' wallets to perform in a consistent way that both consumers and transport staff can quickly become familiar with. Ideally, MNOs will provide wallet APIs that enable transport operators to easily create functions within their own apps that can exchange data with the MNO's wallet.

To help reduce fraud, a transport applet may include some form of identifying personal data, which would enable a ticket inspector to check that the mobile ticket is being used by the individual to whom it was issued. Work is under way in the mobile industry to promote the standardisation and acceptance of secure identification credentials, such as an ID card, that are issued or recognised by governments and public-sector officials. Such a mobile identification system would be a natural complement to a season ticket. The ticket inspector could retrieve the identification data from the SIM using a NFC validation device. Note, if the transport operator decides to use a photograph for this purpose, it might need to be stored on a remote server, in the case that there isn't space on the SIM card – a factor that will vary between operators and markets. That would require the ticket inspector to have a mobile data connection to check the photo.

Handsets and SIM Cards

Mobile and transport operators will need to rigorously test and certify mobile NFC devices – handsets and SIM cards – to ensure that they are compatible with the validation infrastructure. Transport operators are looking for NFC devices to interact with NFC terminals in a consistent way regardless of the operating system they use or the manufacturer of the device. Although NFC-enabled cases and attachments can be added to existing handsets, they can take longer to interact with a terminal than a handset with a built-in aerial and NFC chip.

Moreover, mobile and transport operators want to be able to use the same application across different handset platforms, so they can provide passengers and staff with a consistent experience. Finally, the device's NFC functionality needs to work even when its battery is flat or the device is turned off.

The validation infrastructure

Transport operators' existing contactless validation infrastructure in stations, on-board buses and in the hands of ticket inspectors is typically compatible with the ISO 14443 standard. Although this existing infrastructure should be able to interact with NFC handsets, in some cases a software upgrade may be necessary, as the ISO 14443 standard leaves some room for interpretation. Note, transport operators are unlikely to replace their existing validation infrastructure solely to support NFC. The typical lifespan of this infrastructure is 15 to 20 years.

In Strasbourg, for example, the transport operator CTS didn't want to replace its existing readers, so it is using low cost NFC tags, which are not interactive, rather than NFC readers. The consumer taps the phone against the tag and the SIM is updated the next time the device has a mobile network connection, rather than via NFC.

Other transport operators are trying to make their validation infrastructure as flexible as possible. In theory at least, Transport for London's (TfL) validation infrastructure is designed to accept a contactless payment card in any form factor, including a virtual card stored on a phone or a wristband, as well as a physical contactless card. But, in practice, TfL has plans to make the readers 'time out' if the transaction takes too long. In the TfL system, the first 100 to 150ms are used for the following steps:

- What kind of card it is – Oyster, EMVCo or ITSO?
- Is it on a black list?
- Has it been used on another gate at the same station?

The actual retail transaction comes after these steps. In the case of an EMVCo or ITSO card on a mobile handset, the speed depends on the software architecture in the mobile device, and on the processing steps in the back office. Both factors vary according to the details of the design. Care is needed to maintain the desired throughput. For example, an online remote balance check cannot realistically be done quickly enough for a city metro gate, so the operator has to design a process to bypass that step, while managing risk. Processing time is likely to fall further as the technology matures. Generally, it is desirable to store information, such as tariff structures in the back office, in order to be able to introduce updates centrally rather than having to update the software of every single reader.

Care is also needed to achieve the right balance between making use of intelligence in the reader and intelligence in the mobile device. Although a NFC reader can be configured to select an appropriate card, the transport operator needs to ensure that the reader doesn't preclude the passenger using a mobile wallet or similar app to choose which card they wish to use.

From a technical perspective, the validation of a ticket, or the right to travel, will require a number of application programming interfaces (APIs) to enable data to flow between the consumers' handset, the reader, the wallet and the transport operator's app and back office. Ideally, the APIs should:

- Define the communications protocol
- Support card emulation mode to a contactless terminal
- Define the messages passed between interfaces and devices
- Provide a common communication mechanism and application protocol
- Define key data within the whole architecture that supports integration into the transport operator's architecture.

Privacy

Mobile NFC in transport can enable consumers to benefit from smarter and more intelligent ways of travelling based on their individual needs. However, in order to achieve this consumer experience, there will need to be complex information flows across the newly emerging ecosystem encompassing mobile, transport and other adjacent industries. This can raise consumer privacy concerns about how customer information is collected and used. Seeking and respecting consumers' privacy choices is necessary for gaining their confidence and trust which in turn are crucial factors for the adoption of these new services.

The GSMA and its members have developed and published a set of universal Mobile Privacy Principles to deal with privacy concerns in newly emerging services. These principles describe the ways in which consumers' privacy should be respected and protected when they use mobile services and apps. One key principle relates to 'transparency and notice', which is about being open and honest with consumers when collecting or sharing their personal information.

Consumers' privacy should be respected and protected when they use mobile services and apps.

Summary of the challenges

In summary, the technology landscape described above means that the deployment of mobile NFC services in the transport sector faces a number of challenges:

- **Market fragmentation:** In many countries, the provision of public transport is highly fragmented, involving many different actors, particularly for journeys that go beyond a particular city or region
- **Need for new actors:** To realise the full potential of mobile NFC services in transport, mobile operators and TSMs will need to be integrated into the existing transport ecosystem
- **Deliver multiple services and ticket types through a single device:** Consumers will use their mobile handset to interact with services from many different suppliers, potentially impacting the user experience and creating confusion
- **High level of technical integration and testing:** Although a mobile NFC solution should be consistent with key standards, such as those set by Global Platform, NFC Forum, ISO14443 and AFSCM, a mobile NFC solution will still require a high level of technical integration and testing across multiple systems, devices and infrastructure equipment
- **Privacy concerns:** Some consumers and policy makers may be concerned about the privacy implications of services that may use personal data to provide passengers with personalised information, such as news about their home train station or an update on engineering work on a route they use regularly. Such concerns are more likely to arise where personal data is collected and used in non-transparent ways or where the passengers' permission is not sought.

7.

Roadmap to Commercial Deployment

This section aims to provide a roadmap to commercial deployment and to building scale. At a high level it considers how to implement a mobile NFC ticketing and information service.

Importance of timing

It is critically important for MNOs and transport operators to time the launch of a mobile NFC ticketing solution carefully. They should take into account the following factors:

- The penetration of mobile NFC handsets in their market
- The speed at which the adjacent industries such as retail, hospitality and entertainment are adopting NFC
- The maturity of technology standards
- The case for an incremental approach designed to allow for gradual refinement versus a large-scale deployment designed to achieve economies of scale as fast as possible
- The stance of national and local governments, for example whether they are incentivising transport operators to drive greater usage.

MNO and transport operators should look for opportunities to collaborate

Removing friction in negotiations and processes

As flagged in the previous section, one of the largest barriers to the deployment of mobile NFC ticketing is the complexity of the ecosystem, which includes multiple MNOs, transport operators, systems integrators and equipment vendors.

Rather than attempting large numbers of bilateral negotiations and processes, MNOs and transport operators should look for opportunities to collaborate and remove friction from the process. Collaboration can help individual organisations to cut through the complexity. Some of the ways in which this can be done are:

A joint venture between MNOs

A joint venture between MNOs, such as the Weve mobile commerce venture in the UK, can offer service providers a single technical and commercial platform through which they can reach the majority of consumers. This approach could make it straightforward for transport operators to harness the potential of mobile NFC and generate significant economies of scale. However, establishing a joint venture takes considerable time and effort and will typically require clearance by regulators and anti-trust bodies.

A common technical platform

MNOs can work together to provide transport operators with a common technical platform, encompassing a consistent approach to mobile wallets, provisioning of the secure domain and other processes. This platform could ensure that transport operators can reuse the same technical processes and applications with each MNO. This is the approach taken by the MNOs in France, where they have established L'Association Française du Sans Contact Mobile (AFSCM) to create a common technical platform. However, the existence of a common technical platform does not reduce the need for bilateral commercial negotiations between MNO's and transport operators.

Coordination via a national umbrella body

In Germany, VdV, the ticketing authority, is coordinating both technical and commercial negotiations between MNOs and transport operators. This approach can ensure the use of common technical processes and a consistent commercial framework, enabling both industries to achieve economies of scale. However, in some countries it may be difficult to find an appropriate coordinating body that can balance the interests of both MNOs and transport operators effectively.

A single TSM for transport

The transport operators in a market could work together and appoint a single trusted service manager (TSM) that could then offer MNOs' TSMs a single interface for installing and updating ticketing applications on a SIM card. This approach should create economies of scale for transport operators, but could limit their commercial and technical flexibility.

A TSM hub

If individual MNOs and transport operators each appoint their own TSM, there may be a case for creating a hub through which these TSMs can interact. The hub could be designed to enable a transport TSM, for example, to connect to all the mobile operator TSMs, using a single process. While such an approach would facilitate interoperability, a hub is another element in the value chain, which will need to be financed.

Management and planning

Both transport and MNOs need to take a methodical and thorough approach to the deployment of mobile NFC. They need to begin by developing a clear overarching strategy, supported by concrete objectives. These objectives may be related to specific passenger segments. For example, an MNO may decide to provide a personalised service to young commuters that could evolve into a broader mobile commerce platform. Or a transport operator may wish to use mobile NFC to make it easier for occasional travellers to use its transport network, rather than drive their car.

Note, once the service is commercial, a clear customer service process needs to be in place, which is transparent to passengers, so they don't waste time contacting the wrong entity. Are MNOs or transport operators the first point of contact? Which entity is responsible for addressing which kind of issue? Ideally, the approach to customer service will be consistent across all mobile operators, so the transport operator's staff don't have to deal with each MNO's customers differently.

Examples of actual deployments

France - Strasbourg

In France, each city has its own ticketing system. CTS, the transport operator in Strasbourg, launched ticketing on NFC smart phones running Android in June 2013 in partnership with mobile operators Orange, Bouygues Telecom, SFR and NRJ Mobile. CTS has negotiated a transaction fee with each individual MNO, which it pays for each purchase.

Using the U'Go mobile application, passengers can buy either monthly or daily tickets for bus and tram journeys. Payments of up to €15 could be charged to the user's mobile phone bill or paid via their bank card. For payments higher than €15, users are required to enter their bank card details to complete the purchase. NFC tags are located in tram stations and attached to ticketing machines on buses in the Strasbourg region. Customers can tap their phones against the tags to validate their prepaid ticket before travelling. The transport applet on the passenger's SIM card is then updated via a mobile data connection, as soon as it's possible. The system also allows ticket inspectors to check mobile tickets for up to 24 hours after a passenger's battery goes flat or while their phone is turned off.

CTS isn't using photos for ID. The inspectors typically just check that the ticket has been validated. If they have doubts, they can check the name encrypted on the SIM card and ask the passenger to show some matching ID.

CTS has found that the details of the consumer experience are important. For example, CTS believes the transport app needs to be visually attractive so that consumers will show it to each other. It has also found that the app needs to function in the same way across different handset platforms.

Russia – Novosibirsk, Kazan and Moscow

MTS, VimpelCom and MegaFon, Russia's three largest MNOs, are working together to develop a service that enables people to buy NFC-enabled transport tickets over their networks. The tickets are then stored in the MIFARE® application on the passenger's SIM card.

As of January 2014, the service was nearing the end of a six-month trial period in Kazan. The MNOs plan to scale this project to Novosibirsk and Moscow. The main advantage of the service is automatic top up, which is convenient for customers, as they don't have to stand in queues at ticket offices. The passenger can simply send an SMS to activate the service, after which they can travel on public transport by tapping a phone to a special reader. The trip price is automatically debited from passenger's prepaid phone account. As an additional benefit, passengers receive a discount when they pay this way.

The transport operator pays the MNO a percentage commission for each transaction. Additionally, when the service goes commercially live, the MNOs plan to ask the consumer to make a one-off payment to start to use the service.

MTS is also running a pilot in Moscow with MasterCard to use Mobile PayPass to pay for travel via a SIM application. MTS SIM cards support EMVCo payments and the operator has global approval to use MasterCard PayPass. MTS owns MTS Bank, so the group earns a transaction fee for EMV payments through the bank. VimpelCom and MegaFon also have close partnerships with banks and are ready to implement the same service model if the market demands it.

By the end of 2014, MTS plans to begin using an app and middleware that will enable the consumer to choose the type of ticket and the means of payment. MTS will need to establish its own TSM to facilitate this service, which will need to connect to a transport TSM.

United Kingdom - London

Transport for London (TfL) is moving from smart cards/tickets to direct payments with the ultimate goal of no longer having to issue TfL money in the form of an Oyster Card (TfL's contactless card) or a ticket with a magnetic stripe. In December 2012, TfL began to accept EMVCo contactless credit and debit card payments on 8,500 buses for single journeys costing £1.40. No ticket is issued. TfL has negotiated changes in the scheme rules for transit with the payment networks. In September 2013, TfL was seeing 25,000 contactless payment card transactions a day.

Today, the EMVCo payment is an offline transaction and there is no daily capping, so if a passenger makes ten journeys, they will pay £14. In future, it will be capped and the transaction will be settled at the end of the day, once all the journeys have been aggregated.

In early 2014, TfL plans to enable travellers to use contactless payment cards on the Underground, the Docklands Light Railway, trams and the London Overground rail service, as well as buses. They will also be able to check their journey history online, which means they can see where they've been and how much it cost. TfL says this data will be uploaded within 15 minutes of a transaction, as London buses have 3G connectivity and the stations have fixed line connectivity.

However, TfL notes that a mobile wallet on a handset may disrupt this process, depending on how it is configured, preventing the consumer from seeing their transactions on the TfL website. Similarly, if a consumer changes their payment card during the day, then the TfL system sees that as two different customers and won't apply a cap across both cards. In the third phase, TfL plans to enable travellers to associate a season ticket with an EMVCo contactless card.

In phase four, TfL plans to offer passengers a token (either physical or virtual) that will authenticate them and open the gate. The consumer will be able to download this access token to a secure element on their phone and load cash into a TfL stored value account, associated with the token. The passenger will also be able to associate the token with a debit or credit card, so they always have funds available. TfL envisages that the consumer will be able to use this token via a mobile wallet or via the TfL app. By phase four, TfL says there will be four ways for passengers to pay for a journey: via a contactless payment card (which could be on a phone), the existing contactless Oyster card, the TfL token (which could be on a phone) and by buying a ticket.

TfL believes MNOs could add value by providing a way to dynamically download its planned token on to the handset. A MNO, for example, could send a message to a new visitor to London asking them whether to wish to download the TfL token.

TfL has created its own proprietary IT system to manage the back office fares and aggregation and the middle office payments and risk system. It plans to offer use of this system to other transport operators in return for a fee.

8.

Next Steps

Next steps to be addressed by the mobile and transport sectors

- The mobile and transport sectors, together with adjacent and complementary industries, need to create innovative cross-sector services in a collaborative way. To provide a robust foundation, the mobile industry is developing an integrated mobile wallet to ensure efficient and simple service provision and operation. This requires consistent MNO business-to-business (B2B) interfaces and simplified business processes. Efficient onboarding of services and collaboration among service partners will also be essential

- Mobile and transport operators, and their technology suppliers, need to ensure the compatibility of standards and certification across the mobile and transport value chains (including compatibility with the existing validation infrastructure)

- The transport and mobile industries will need to support multiple ticket types on a single device, and develop door-to-door integrated services with the mobile as a key enabler. The transport industry is already building the necessary relationships within the sector; into the future the mobile and transport industries will need to cooperate to establish the necessary interoperability

- The transport industry, encouraged in some cases by the public funding of research projects, is working on joining up planning and ticketing information. The mobile industry needs to connect with these initiatives, and encourage the integration of information and services from the wider ecosystem, such as local commerce information

- Consumers will only adopt new services, which may collect and use their personal data, if they trust those services. The GSMA is therefore working with its members and partners to promote a set of universal Mobile Privacy Principles and ensure consumers' privacy choices are sought and respected by companies offering such services

To provide a robust foundation, the mobile industry is developing an integrated mobile wallet to ensure efficient and simple service provision and operation.