M-Ticketing Whitepaper

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1 DOCUMENT PURPOSE

This document has been prepared to provide background information, context and recommendations for the successful introduction of Universal Integrated Circuit Card (UICC)-based Near Field Communications (NFC) enabled Mobile-Ticketing services that will help drive the development and adoption of smart-ticketing (electronic purchase, issue and redemption of tickets) and integrated-ticketing (co-ordination of ticketing activities between different ticket issuers).

2 EXECUTIVE SUMMARY

Mobile ticketing or 'M-Ticketing' in which a virtual ticket is held on a mobile phone provides an opportunity to increase the efficiency of ticketing operations in the transport and entertainment sectors and to drive increased business by improving access to ticketed services.

While there is a simple convenience to carrying 'tickets' on a mobile phone that most ubiquitous of devices which is always to hand the GSMA's market research, introduced in section 5 of this paper, indicates that there is significant additional customer attraction in buying and managing tickets via a mobile phone.

There are 'smart' ticketing schemes in operation today, which rely upon technologies such as 2D barcodes. However, the GSMA's research clearly identified NFC as the technology of choice for smart ticketing and therefore, for M-Ticketing.

Travellers, ticket issuers and agents and Mobile Network Operators (MNOs) alike could benefit from value added services designed to enhance the travel and entertainment experience that could be created for, delivered to and consumed on the mobile device alongside an M-Ticket.

A number of key technical and commercial challenges prevent realisation of the M-Ticketing vision today. NFC-capable mobile handsets are not yet sufficiently widely deployed. Key technical interfaces which would enable the delivery, presentation and validation of smart tickets via the mobile phone need to be properly standardised.

3 INTRODUCTION

M-Ticketing is an industry initiative to introduce, enhance and improve the role of the mobile phone in ticketing services and the ticketing services value chain. Use of the mobile phone to enable users to buy tickets and to carry tickets within the phone's secure UICC will establish a ubiquitous alternative to conventional electronic card-based tickets and provide new and enhanced functionality as well as convenience to end users.

M-Ticketing will also provide opportunities for service providers such as ticket agencies to access new channels via the mobile handset to bring value added services, such as traveller guides, to market.

MNOs are uniquely placed to accelerate the development of an M-Ticketing framework and facilitate the development of a thriving M-Ticketing ecosystem. They own and control the UICC which today contains a mobile subscriber's Subscriber Identity Module (SIM) but which tomorrow could also contain a mobile subscriber's M-Tickets. Moreover, they operate interconnected networks world-wide and can already provision services and settle transactions right around the globe.

Equipment vendors will have opportunities to provide the physical equipment necessary to issue and read M-Tickets, for example entry gates and inspection points. It is therefore important that M-Ticketing can integrate with existing electronic ticketing infrastructure.

It is the GSMA's objective to provide recommendations for the implementation of mobile ticketing services, focusing on open, standardised and interoperable solutions.

4 M-TICKETING SCENARIOS

The following scenario illustrates how M-Ticketing could have an impact on our daily lives.

06.48 am	*"John Smith commutes into the city every day. He parks his car at a mainline station. He swipes his mobile over the ticket barrier to gain access to the platform. The NFC reader interrogates the season ticket that is securely stored in his UICC and the barrier opens.*
06.52 am	*Once on the train, John can pay for the parking ticket that he didn't have time to buy at the station. It only takes a few button presses on his mobile to do this.*
07.00 am	*Next he checks the balance on his metropolitan transport card. It's running low. He tops it up, again with just a few button presses on his phone, and can relax for the remainder of the journey knowing that there will be no unnecessary queuing at the ticket machines when he arrives at the busy city terminus.*
11.15 am	*During the day John learns that an important client is in town. More than that, the client would love to see the championship football match that evening. John's PA surfs the web to find a pair of tickets for the game.*
12.05 pm	*John's Personal Assistant (PA) has finally found some match tickets. She makes a booking and arranges for the tickets to be sent directly to John's mobile. John receives a message to confirm that the tickets have arrived.*
06.50 pm	*After a meeting at the office, John and his client head to the football stadium. It's easy for John to pay both their fares on the metropolitan rapid transit system. John is able to tap his phone against a 'smart timetable', which uses NFC to read the departure time and platform number for the next train to the football stadium.*
07.05 pm	*Once they're seated, John pushes one of the match tickets from his own phone to his client's.*
07.20 pm	*On arrival at the stadium they each gain entry to the ground by swiping their mobiles at the turnstile.*
10.45 pm	*If he were being really organised, John would buy tomorrow's car parking ticket as he travelled home on the train. But it's been a long day and it's really no trouble: that's one task that can wait until the morning."*

This day in the life of John Smith highlights a number of key issues that will be faced in the M-Ticketing future:

- M-Tickets may be used for travel or for events
- Travel may be scheduled (the rail season ticket) or *ad hoc* (the metropolitan transport card)
- Tickets may be purchased by and issued to the same person (car parking)
- Tickets may be purchased on behalf of another person (the match tickets)
- One person may hold tickets for a number of travellers (John and his client or, say, parents and their children)
- Stored tickets can be conveniently viewed on a mobile phone (checking balance on metropolitan transport card)
- Many types of ticket may be procured from many sources through a single mobile.

A more detailed treatment of the M-Ticketing use-cases is provided below.

All the individual capabilities required to realise such a future are available today. However, a common framework within which the many stakeholders transportation authorities, promoters, ticket agents, mobile network operators and others can collaborate does not yet exist.

The following use cases, described in further detail in Annex 2, have been identified for M-Ticketing.

- Provide user with information related to the service they are using or considering using
- Ticket Purchasing
- Ticket Validation
- Ticket Validation in a call
- Ticket Validation where a single user validates multiple tickets for a group
- Post-paid Tickets
- Echo of Transaction displayed on mobile screen
- Control of Ticket Validity
- Cancellation of Tickets
- Multiple Ticket Applications on same UICC – Auto Selection
- Peer to Peer Ticket Transfer
- Handset as a Ticket Reader
- Handset as a Ticket Reader and Writer
- Active and Expired Contracts Management
- Application Provisioning
- Handset Broken/Lost/Stolen
- Change of SIM/Operator Use Case, Ticket Migration
- Proof of Handset Ownership

5 GSMA'S MARKET RESEARCH

In order to gain an insight into the M-Ticketing opportunity the GSMA commissioned a research project to examine:

- The key needs and issues with implementing a M-Ticketing service
- The opportunity which M-Ticketing will provide the mobile operators
- Potential business models for M-Ticketing implementations.

The focus of the research was the support of M-Ticketing using UICC based NFC as the prime enabling technology, considering other technologies such as 2D bar codes only as secondary/fall back methods. It is expected however that M-Ticketing services using SMS and Bar Code implementations will be prevalent until the point that a critical mass of NFC enabled handsets is available.

Although the scope of this research included event ticketing as well as transportation, the focus of the interviews generally considered the adoption of transportation focused M-Ticketing, as this is expected to provide the first mass market uptake of NFC services using a mobile handset.

5.1 Organizations Interviewed

The following types of organisation were surveyed:

- NFC chipset and OS vendors
- NFC Service Providers
- SIM Vendors
- Reader Equipment Vendors
- Transport Ticket Suppliers
- Public Transport Authorities

5.2 M-Ticketing Benefits

5.2.1 Consumer Benefits

Ease of use was seen as a key potential benefit of M-Ticketing. The use of a mobile phone makes it convenient to buy tickets while on the move or away from a normal purchase point; this helps users to avoid queues and make better use of 'dead' time. It also makes it possible to view tickets, to check the usage history of used and expired tickets and to review the remaining credit on multiple-use tickets.

M-Ticketing is also seen as a way to reduce 'free riding'. A significant number of free riders are people who turn up late for transportation and do not have the time to buy a regular ticket. M-Ticketing would remove the obstacles that prevent timely post-purchase of an appropriate fare.

Further benefits are seen in the integration of location based services and other value-added services to enable a channel providing enhanced value-added content associated with the tickets on the UICC. For example when travelling on an unfamiliar route a location-aware application with knowledge of the ticket could deliver a personal notification of journey's end, showing the traveller where to alight from the bus or tram.

The following attributes were those most commonly identified with M-Ticketing:

- Ease of use
- Reliability
- Appropriate pricing
- Automatic ticket selection
- Buying, paying and loading the ticket over the air for general convenience but especially for 'queue busting'
- Browsing the content of the ticket by phone
- Avoiding the need to carry cash or credit cards on certain journeys
- Reduced crime as a result of (i) less cash being carried on buses (ii) fewer 'freeriders' whose behaviour is likely to be more antisocial than that of other passengers
- Using the mobile phone and UICC as contactless card.

5.2.2 Ecosystem Benefits

The following ecosystem benefits are anticipated as a result of successful M-Ticketing deployment:

- Cost savings, reduced marketing, sales and distribution costs
- Environmental, (i) by driving increased use of public transport (ii) by replacing paper tickets which are perceived to be wasteful, particularly in the case of magnetic stripe tickets which are not recyclable
- Enhanced security, (i) at a transactional level in the purchase, distribution and authentication of tickets (ii) at a personal level through reduced risk of crime when using public transport (because of reduced use of cash, see 5.2.1 above).
- One-to-one marketing smart posters with advertising capabilities can increase operator revenues
- Increased customer retention for MNOs, lower churn as the mobile handset valuable, integrated capabilities beyond voice and data services.

5.3 Technology Support

5.3.1 NFC as the Prevalent Technology

NFC was seen as the prevalent and preferred technology (to be) used by all the players, even those which supported or provided magnetic stripe and bar code services or technologies. The ticket service providers, ticketing infrastructure vendors and transport authorities already support NFC via issued cards and all were keen to have card emulation technology available within the handset. (Card emulation enables NFC capability within a mobile phone to be configured so that to an NFC reader the mobile phone and UICC appears to be a standard NFC card.)

The most secure and preferred method for implementation of NFC on the handset is using a separate NFC module in the handset which communicates with the application on the UICC using the secure Single Wire Protocol (SWP[1]).

[1] Reference GSMA Requirements for SWP NFC Handsets V3

5.3.2 M-Ticketing Drivers

It is believed that M-Ticketing will catalyse the widespread adoption of NFC services on mobile phones in many markets. The initial success of M-Ticketing on handsets is likely to be built upon the success of NFC plastic card implementations used on existing public transportation systems.

For some implementations the issuance costs only substantially reduce when paper tickets are completely eliminated, as maintaining any paper ticket distribution capability incurs significant fixed cost. This may not be the case for higher value tickets such as event, or high cost travel, tickets where a ticket handling premium is often added.

5.4 Implementation Considerations

5.4.1 Equipment Lifecycle

For many mobile users it will be necessary to replace their SIM card with a UICC before they can make use of M-Ticketing services. Similarly some transport authorities will have to replace or upgrade ticketing and gating infrastructure to properly support NFC operation. Replacement intervals for SIM / UICC cards are typically significantly shorter than for ticketing infrastructure.

5.4.2 Availability of Devices

The introduction of SWP NFC based M-Ticketing will depend upon the availability of a critical mass of SWP NFC enabled devices.

5.4.3 Security

Security is paramount for NFC to be a success. End-to-end processes need to be in place to ensure that new applications cannot damage or corrupt the UICC, and to ensure that data from the UICC cannot be copied.

Security issues need to be managed carefully as a major security problem could erode consumer confidence in NFC technologies, stalling or significantly reducing the M-Ticketing business opportunity.

It should be noted that SWP NFC implementations in a mobile phone will offer a level of security that is at least equivalent to that offered by a stand-alone NFC card.

5.4.4 Standards

Standards are seen as critical to the success of M-Ticketing, and it is important to support open standards. However it is unlikely that all standards will be supported on all devices. The standard most commonly cited during the research were the ISO 14443 (A & B) standard which appears to be the most prevalent. ISO18092 infrastructure is widely used in Asia, notably in Japan, Singapore, Taiwan & Hong Kong.

Proprietary de-facto standards are also important with MiFare being currently the most popular of these proprietary technologies. Regional proprietary standards such as Calypso and ITSO were also mentioned and may be important to support. It is important that current popular proprietary standards are accommodated to allow easy integration to existing systems.

5.4.5 Opportunities Identified by the Research

The feature that would be attractive from a customer proposition is obviously the ability to instantly buy and manage tickets on the device, independent of time and location. It was also viewed as a key advantage to be able to view tickets and a transaction log on the handset, which is a service that cannot be offered with a conventional NFC card.

It is generally perceived that a better service can be provided to the customer using a mobile phone application when compared with normal card-based NFC services, with additional features such as those described above being available to the user.
It is also thought that the introduction of M-Ticketing can reduce the cost of ticketing issuance. Transport authorities and other Service Providers are keen to achieve any cost savings they can.

M-Ticketing also provides a new channel for Service Providers to engage with their customer, allowing for direct promotions and other marketing opportunities based on the ticketing service offered.

6 CHALLENGES FOR M-TICKETING

A number of gaps prevent John Smith enjoying the experience described in section 4. These have been grouped into business, technology and standards challenges. They have been sourced directly from market research and from further analysis undertaken by the GSMA.

6.1 Business

Key business issues that need to be addressed are grouped into two categories: smart ticketing and integrated ticketing. These are described below.

6.1.1 Smart ticketing

Smart ticketing describes the electronic payment, issue and redemption of tickets. M-Ticketing makes smart ticketing possible via mobile devices.

Although the MNO will issue and retain ownership of the UICC, users will rightly perceive that tickets stored on the UICC are their own property and not the property of the MNO. If a user wished to migrate their mobile telephone service from one MNO to another they would expect to keep any tickets that were stored in their phone and UICC. However, such migration would require a new UICC to be issued, so tickets stored on the old UICC would have to be transferable.

Ticket holders will need to be able to manage tickets effectively, sharing them (in the case of travelling groups) and replacing them promptly in the event that their mobile phone becomes lost or stolen.

A 'trusted party' is needed to configure ticketing applications in the UICC, to control user data and ticket data and to ensure that tickets remain separate from and transferable between the MNOs even though those tickets will reside on the UICC owned by an MNO. Examples of a trusted party could be the MNO, the transport operator or any company trusted by all parties in the eco-system.

Enabling infrequent users of ticketed services (such as families taking a day-trip to the capital rather than the regular commuter) to use smart tickets is desirable for transportation authorities, as it will reduce ticket issuance costs. Today they lack platforms for enabling this. Establishing payment schemes that do not require pre-registration of bank or credit card details will be key to attracting *ad hoc* users. When infrequent users are from overseas the payment problem could be exacerbated. In both cases, an M-Ticketing approach could increase the ease of occasional smart ticket use by providing a convenient user-interface for ticket 'discovery', purchase and delivery.

6.1.2 Integrated ticketing

Integrated ticketing describes the interconnection of ticketing among multiple transport operators so that, for example, a ticket issued by one operator will be honoured by another. Integrated tickets do not have to be 'smart'; a transport operator can issue a paper ticket that will be accepted on another transport operator's service. However, the introduction of smart ticketing will facilitate the development of integrated ticketing.

Integrated ticketing will be driven by market opportunity. The purchase of a ticket that combined Eurostar to Paris Gare du Nord, bus transfer to Charles de Gaulle, flight to Jakarta and Mass Rapid Transit pass for use in the Indonesian capital would be impressive. However, the incidence of such purchases will, in all probability, be too low to justify investment in the creation of any specific interworking capabilities.

While there is no common implementation for worldwide ticket delivery today, there are lessons to be learnt from the evolution of international mobile roaming. In its early days, MNOs struck one-to-one deals for international roaming. The largest players with the most to gain made the first move. As the market matured roaming hubs were introduced to simplify too many connections between MNOs thus enabling near universal international roaming that mobile subscribers enjoy today.

Say for limited cases, there is not a seamless experience when moving between transport jurisdictions, nor is there a common implementation for a worldwide ticket delivery. This is not helped by the fragmentation of existing contactless infrastructure with NFC technology.

The integrated-ticketing business-model challenge compounds the smart-ticketing business-model challenge by adding the need for multiple transport operators to access the smart-ticketing infrastructure. Such access will have to enable clearance of domestic and international payments and the national and international delivery and validation of tickets.

6.2 Technology

A key technical challenge is to build a standardised ticketing system that enables migration from the proprietary ticketing schemes in place at present, and also fits seamlessly with Pay-Buy-Mobile[2] mechanisms.

Key areas that need addressing fit into two principal categories: handsets and infrastructure.

6.2.1 Handsets and UICC

It is perfectly possible that multiple smart tickets will be supported in a single UICC. There is today no standard way to manage multiple ticketing applications and their selection by the end user. So, for example, when John Smith swipes his mobile across the gate to gain access to the station platform the right application in the UICC needs to be connected to the 'contactless front end' so that his railway ticket rather than his football match ticket is presented for validation.

Many 'ticket' readers are not designed to support Battery Off mode. No standard field strength report is defined for the readers to support Battery Off mode in the handset. Unlike a standalone NFC card that sources all the energy it needs from the reader at the time of interrogation, the mobile handset's SWP NFC implementation may require a power supply, albeit limited, from the handset's battery. In the absence of Battery Off mode support, the handset would have to be powered up to operate as an NFC card. Conversely, if the handset's battery is exhausted, the phone and UICC will not be serviceable as a standalone 'NFC card'.

At the time of writing, the number of SWP-NFC handsets in operation is still quite limited. MNOs and other parties will need to see a higher density of SWP-NFC devices deployed if they are to invest in new infrastructure to support the introduction of M-Ticketing.

Certain types of paper ticket incorporate photo-ID. This prevents a season-ticket issued to a single traveller from being shared amongst multiple travellers. While smart tickets can eliminate certain types of season-ticket fraud for example, it is relatively easy to ensure that a smart season ticket is only used for one inbound and one outbound journey each day, they cannot necessarily limit use of that ticket to a single traveller.

6.2.2 Infrastructure

There is today no standardised mechanism for the provisioning of ticketing applications on the UICC or for the over-the-air (OTA) download of tickets. Nor is there any standardised scheme for license management of proprietary NFC-ticketing applications such as MiFare.

Furthermore, there are no interfaces in place between MNOs and ticketing organisations to affect OTA of tickets even though this has been identified as a key, desirable attribute of M-Ticketing.

Taken together, these highlight a number of gaps which are encountered in the following sequence:

- No scheme for provisioning of UICC ticketing application for a given ticket or ticket type.
- No scheme for handling OTA purchase and delivery of tickets.
- No scheme for handling payment and payment clearing between ticket issuers, ticket agents and MNOs.

It is recognised that even when such schemes are in place, it will be necessary to allow for migration from the disparate, proprietary services deployed today to industry-wide platforms in the future.

[2] Pay-Buy-Mobile is a GSMA initiative where the NFC service applications are stored in the UICC, which communicates with the NFC chip in the mobile phone via the SWP interface.

6.3 Standards

All ticketing implementation solutions currently in use are proprietary. No standardisation bodies have released a standard for M-Ticketing. This means that many solutions are under control of one commercial entity with IP rights.
Some proprietary ticketing solutions are based principally on hardware implementations. They are not designed to reside and run in a multi-application environment such as a Java Card SIM card. Storage of multiple ticketing services on one Secure Element is not supported through standards and automatic ticketing service selection is also not supported through standards

In most cases post-issuance loading of ticketing applications is not possible through currently defined standards, although some proprietary standards make this possible. This means that the cost of the ticketing application might have to be borne up-front regardless of whether or not the ticketing application is subsequently used. This increases costs for the card issuer that is, the MNO, without necessarily delivering any benefit.

Ticketing standards are not designed to communicate through OTA systems, adding complexity to the mobile ticketing solution.

6.4 Business and Market constraints

The main critical factors that need to be resolved before a successful implementation can be achieved are:

- Establish clear business and cooperation-models
- Establish clear understanding of costs and benefits
- Achieve deployment of SWP NFC devices in commercial quantities
- Overcome incompatibility of devices and standards.

Unclear business and cooperation models constrain investment in NFC services. The fundamental issues surrounding the commercial deployment of NFC in ticketing are related to the value chain. The roles of stakeholders, the lack of satisfactory pricing models and questions of how to share revenues between different stakeholders must be addressed.

The lack of SWP NFC devices in commercial quantities is also slowing down NFC adoption and service development. The key constraint for mobile ticketing is the availability of capable handsets. Mobile ticketing solutions are dependent on suitable handsets before widespread adoption can take place.

Other aspects have been highlighted as potential factors to be addressed to ensure the success of M-Ticketing:

- User perception that NFC is not secure
- Usage is too complex
- Wrong marketing messages.

7 RECOMMENDATIONS FOR THE SUCCESS OF M–TICKETING

Successful M-Ticketing will depend upon a vibrant ecosystem that can harness the power of markets to pair 'problems' with 'solutions'. Multiple sources of supply at each level in the ecosystem will drive the necessary competition and innovation.

Standardisation work is needed to overcome a number of fundamental limitations with today's technologies. However, the ambition of such standardisation work should be limited to core enablers. Mandating mechanisms for the remote provisioning of a ticketing application within the UICC will open up possibilities for many ecosystem participants. In contrast, dictating engagement methodologies between all ecosystem participants large and small could delay the availability of core standards while at the same time constraining innovation in technical and commercial domains.

Meanwhile, a commercial model similar to that identified in the EPC-GSMA TSM Service Management Requirements and Specifications [doc ref 3] will ensure that the commercial environment is sufficiently open and flexible to develop the business models required to make M-Ticketing succeed.

7.1 Technology related recommendations

- For the best customer experience and to provide the best customer support, ticketing services should be based on NFC-SWP handsets and the use of the UICC as the Secure Element. There is a GSMA procurement specification in place for NFC-SWP handsets[3].

- Standardisation work should proceed with the objective of establishing critical enablers, while allowing the market to decide the scope and pace of higher levels of integration. Sufficient standardisation should make it possible for a transport operator or event ticketing operator to get their NFC application instantiated on the consumer's mobile, so enabling their tickets to be sold, delivered and redeemed via the mobile device. This presents transport operators and event ticketing operators with an immediate business opportunity and each will be able to make its own investment decisions. Once multiple transport operators can manage M-Tickets in this way the scene will be set for them to find ways of collaborating to deliver integrated services and nothing in the lower-level standardisation should militate against this.

Therefore the standardisation focus should be:

- *OTA* delivery and provisioning of UICC ticketing applications.
- *Definition* of a multi-application co-operation schema so that multiple ticketing applications can be co-resident in the UICC, addressing (i) mandatory proximity detection when the mobile device is presented to an NFC reader and (ii) optional selection via a user interface that executes in the mobile handset.
- *Definition* of APIs to allow handset applications to communicate with ticketing application so that user can scrutinise any and all tickets stored on the UICC.
- *More detailed research* into currently deployed smart-ticketing services should be conducted to identify technical interfaces, with a view to facilitating carefully selected, commercially viable trials as soon as the standardisation work is sufficiently mature.

[3] See GSMA Requirements for SWP NFC Handsets V3

8 ANNEX 1: GLOSSARY

The following definitions are involved in the M-Ticketing Use Cases:

Customer - the entity that pays for a ticket. This is often the same entity as the End-User but it may be different entity when, for example, companies buy tickets for their staff, or parents buy tickets for their children.

End-User - a physical person operating through a client application, i.e. the person who carries the handset in which the ticket is stored and who carries the mobile phone on a journey or to an event.

Infrastructure Vendor Organisations - providers of ticketing infrastructure such as NFC readers, automatic gate entry devices, ticket inspection machines, ticket vending machines.

Mobile Network Operator (MNO) - a network operator providing voice and/or data services to handset users. The MNO may own its own physical network, or it may use other network facilities in which case it is a MVNO (Mobile Virtual Network Operator).

Over The Air (OTA) - the method of sending data or applications to handsets using the wireless radio network (over the air).

Subscriber Identity Module (SIM) - an application on the UICC containing a mobile subscriber's unique identity.

Single Wire Protocol (SWP) - the standardised interface between the UICC and a radio transceiver (often referred to as the 'contactless front end') which enables a suitably equipped mobile phone to emulate the operation of a standard NFC card.

Service Provider - a body, or an agent acting on behalf of a body, that providers a service for which tickets are issued. Such a body might be a transportation authority or an event promoter.

Trusted Service Manager (TSM) - a trusted third party to whom MNOs or Service Providers entrust the operation of some or all of their Service Management functions.

Universal Integrated Circuit Card (UICC) - a physically secure device, an IC card (or 'smart card'), that can be inserted and removed from the terminal equipment. It may contain one or more applications. Examples of such applications may be a USIM and the SIM. Often the UICC is erroneously denoted as the 'SIM' or 'SIM-card' (SIM is an application on the UICC).

9 ANNEX 2 USE CASES AND ROLE DEFINITIONS

NFC operates in three different modes:

- ***Card Emulation Mode:*** These are the use cases when the principle mode of operation of the handset is to emulate a NFC card.
- ***Tag Reading Mode:*** These are the use cases when the principal mode of operation of the handset is to read tags.
- ***Reader / Writer Modes:*** These are the use cases when the principle mode of operation of the handset is to read tags or devices write to other devices or tags.
- ***Peer to Peer Mode:*** This use case has the principle mode of operation that transfers tickets between devices.
- ***Other Use Cases:*** These use cases consider other scenarios of operation for the eco-system including provisioning and lifecycle management of the applications and handsets.

The high-level primary use cases envisaged today are summarised below.

Use Case 1: Handset provides user with information related to the service they are using or considering using

Description:

- The handset is in Tag reading mode
- The consumer swipes the Handset near the card reader
- The handset reads the NFC Tag content and executes the corresponding action (launch browser, call set-up, etc.)
- The user enters a session with the information system

Dependencies:

- The handset has the capabilities to read the tag
- The handset can automatically execute the desired operation

Actors:

- Handset, in tag reading mode
- Programmed NFC tag

Use Case 2: Ticket Purchasing

Description:

- Via the UICC application and handset MMI
- The user selects the 'buy a ticket' option via a handset MMI
- The handset instructs ticketing infrastructure to deliver the ticket
- The ticket contract is loaded to the handset via OTA
- Via mobile internet
- The user selects the 'buy a ticket' via a mobile internet application
- The internet application instructs ticketing infrastructure to deliver the ticket
- The ticket contract is loaded to the handset via OTA
- Via Ticketing Machine
- The user opts to buy a ticket at a ticketing machine
- The ticket machine authenticates the purchase
- The ticket contract is loaded to the handset from the machine
- Types of tickets for purchase
- Return tickets
- Day travel
- Multi-day
- Discounted tickets (e.g. child, student, OAP)
- Event tickets
- Tickets to gift to others
- Multiple tickets that are used at the same time (for same journey or event)
- Ticket purchase only for delivery at a later date

Dependencies:

- Device capabilities (mobile internet, screen etc.)
- Ticketing system (to deliver via OTA or existing infrastructure)

Actors:

- Handset, with ticketing application installed and set up
- Purchase points and delivery mechanisms as described

Use Case 3: Ticket Validation

- **Description:**
- On entry
- The handset is swiped on the NFC entrance gate
- If the device is recognised as stolen the gate does not open
- If no transport/event contract exists the gate does not open
- If a valid transport/event contract exists the gate opens
- The transport contract is updated
- On exit If applicable
- On exit the handset is swiped at the exit gate
- If the journey was outside the contract that was originally purchased, the gate stays locked
- If the journey was valid the gate will open
- The transport contract is updated

Dependencies:	Actors:
Application is loaded on the handset	Handset, in card emulation mode NFC reader at point of use, e.g. event or transport terminal

Use Case 4: Ticket Validation in a call

Description:

- The mobile phone is in a call
- As PPT04 or PPT06 (Ticket function operates independent of other phone operations)

Dependencies:	Actors:
Application is loaded on the handset	Handset, in card emulation mode NFC reader at point of use, e.g. event or transport terminal

Use Case 5: Ticketing Validation where a single user validates multiple tickets for a group

Description:

On entry

- The user buys multiple tickets, potentially at different tariffs for a group of people that are on the same journey together or attending the same event.
- The handset is swiped on the entrance gate NFC for each ticket (may be implementation specific)
- If the device is recognised as stolen the gate does not open
- If no transport/event contract exists the gate does not open
- If a valid transport/event contract exists the gate opens
- The contract(s) is updated

On exit If applicable

- On exit the handset is swiped at the exit gate for each person in transit (may be implementation specific)
- If the journey was outside the contract that was originally purchased, the gate stays locked
- If the journey was valid the gate will open
- The transport contract is updated
-

Dependencies:	**Actors:**
▪ Application is loaded on the handset	▪ Handset, in card emulation mode ▪ NFC reader at point of use, e.g. event or transport terminal

Use Case 6: Postpaid Tickets

Description:

- On entering the public transport network the handset is swiped on the entrance gate NFC reader
- If the device is recognised as stolen the gate does not open
- The time and location is logged by the transport system and on the Handset (may be implementation specific)
- On exiting the handset is swiped at the exit gate
- The location and time is logged in the system and the cost of the travel ticket is computed
- A confirmation on the screen or a beep may be heard from the handset (may be implementation specific or covered by the Echo of Transaction displayed on mobile screen use case)

Dependencies:	**Actors:**
▪ Application is loaded on the handset ▪ User is subscribed to a post pay contract	▪ Handset, in card emulation mode ▪ NFC reader at point of use, e.g. event or transport terminal

Use Case 7: Echo of Transaction displayed on mobile screen

Description:

- On passing the electronic gate the handset is swiped on the entrance NFC reader
- Upon completion of the transaction attempt a success or fail is shown on the screen's display

Dependencies:

- Application is loaded on the handset
- The device has a compatible screen

Actors:

- Handset, in card emulation mode
- NFC reader at point of use, e.g. event or transport terminal

Use Case 8: Control of Ticket Validity

Description:

- Upon request the user's ticket can be validated using special NFC reading equipment
- Upon reading the handset, the specialist NFC reading equipment will show information it has received from the card (e.g. information in relation to journey being undertaken)

Dependencies:

- Application is loaded on the handset
- The reading device has appropriate screen
- Only an authorised device can access the information from the UICC

Actors:

- Handset, in card emulation mode
- NFC reader on validation equipment

Use Case 9: Cancellation of Tickets

Description:

- The application is updated to invalidate or cancel the ticket
- The ticket may be cancelled by the service provider, e.g. upon expiry or cancellation of event or journey
- The ticket may be cancelled by the user, and a refund process initiated

Dependencies:

- Application is loaded on the handset
- Appropriate process is in place to deal with ticket cancellation

Actors:

- Handset
- NFC infrastructure in place

Use Case 10: Multiple Ticket Applications on same UICC – Auto Selection

Description:

- There are multiple similar UICC M-Ticketing applications on a device
- When the device is presented to a card reader the reader should identify the application which is relevant to it and perform the desired action with no user intervention

Dependencies:

- Multiple applications are loaded on the Handset
- Appropriate process is in place to deal with multiple applications

Actors:

- Handset, in card mode
- UICC with multiple applications
- NFC reader infrastructure in place

Use Case 11: Peer To Peer Ticket Transfer

Description:

- Two handsets are tapped or held closely together to transfer a ticket or ticket from one device to the other

Dependencies:

- Application is loaded on the handset
- Handset with tickets to transfer
- Tickets must be transferable

Actors:

- Handset, in card writer mode
- Handset, in card reader mode

Use Case 12: Handset as a Ticket Reader

Description:

- The ticket status can be checked by tapping of holding closely together the reading device against the device with the valid ticket
- The status is seen and can be stored and or logged on the validating terminal

Dependencies:

- Application is loaded on the handset

Actors:

- Handset, in card mode
- Handset, in card reader mode

Use Case 13: Handset as a Ticket Reader and Writer

Description:

- The ticket status can be checked by tapping the reading device against the device with the valid ticket and the ticket data is updated (ticket checked or used)

Dependencies:

- The handset is accepted by the ticketing provider as a valid Point Of Sales device

Actors:

- Mobile NFC Equipment, in card mode

Use Case 14: Application Provisioning

Description:

- The handset is OTA-enabled
- The user selects the application via the handsets MMI and it is loaded on to the UICC via NFC equipment or Over The Air
- The application is instantiated on the handset
- The application can then be personalised with information

Registration Types:

- Simple, with minimal information and no additional user data
- Complex, with additional user data, e.g. Date of Birth, ID number, picture, discount vouchers, etc

Dependencies:

- The handset has the relevant capability to receive and install the UICC application

Actors:

- Handset with NFC
- UICC
- NFC provisioning infrastructure in place
- OTA Infrastructure as part of Service Management functions

Use Case 15: Active and Expired Contracts Management

Description:

- The user access the UICC application using the handsets input and output interfaces (typically screen and key pad)
- The user's contract(s) or ticket(s) may or may not be provisioned on the handset
- Via the handset the user can consult the status of the transport contracts provisioned on the handset
- The contracts typically have a finite validity
- The user can see any tickets that have been cancelled, expired or used and not been deleted
- The user can view their credit balance or unused tickets

Dependencies:

- Application is loaded on the handset
- The device has a compatible screen and input devices to navigate contracts

Actors:

- Handset

Use Case 16: Proof of Handset Ownership

Description:

- Upon request the user's handset should be able to be validated using special NFC reading equipment
- Upon reading the handset, the specialist NFC reading equipment will show identification information it has received from the UICC application (e.g. name, address, picture, date of birth or some other secret data)

Dependencies:

- Application is loaded on the handset
- The reading device has appropriate screen
- Only an authorised device can access the information from the UICC

Actors:

- Handset, in card emulation mode
- NFC reader on validation equipment

Use Case 17: Handset Broken/Lost/Stolen

Description:

- Old application is invalidated
- An image of the NFC application is created on a new UICC (via OTA or using NFC)
- Valid tickets and other journey related data is provisioned on the UICC

Dependencies:

- The user loses, breaks or has their handset stolen

Actors:

- UICC
- Handset
- OTA Infrastructure

Use Case 18: Change of SIM/Operator Use Case, Ticket Migration

Description:

- A user may have to change a SIM or want to change their mobile service provider.
- It should be possible for applications to be provisioned on the new UICC/phone including all active tickets/credits which are on the old device.

Dependencies:

- Application is loaded on the handset
- Appropriate process is in place to deal with porting applications to new UICC's

Actors:

- Handset, in card emulation mode
- UICC
- OTA Infrastructure

Use Case 19: Any Network Ticket Purchasing

Description:

- The user from city A would like to buy a ticket for transportation in city B
- Via the UICC application and handset MMI

- The user selects the 'buy a ticket for Any Network' option via a handset MMI
- The user selects the appropriate ticketing network
- The Handset instructs ticketing infrastructure to deliver the ticket
- The ticket contract is loaded to the handset via OTA

Via mobile internet

- The user selects the 'buy a ticket for Any Network' via a mobile internet application
- The user selects the appropriate ticketing network
- The internet application instructs ticketing infrastructure to deliver the ticket
- The ticket contract is loaded to the handset via OTA

Types of tickets for purchase

- Return tickets
- Day travel
- Multi-day
- Discounted tickets (e.g. child, student, OAP)
- Event tickets
- Tickets to gift to others
- Multiple tickets that are used at the same time (for same journey or event)
- Ticket purchase only for delivery at a later date

Dependencies:

- Accessible application 'buy a ticket for Any Network' to help the end-user to find the appropriate site to buy the ticket in another town or country
- Device capabilities (mobile internet, screen etc.)
- Ticketing system (to deliver via OTA or existing infrastructure)

Actors:

- Handset, with ticketing application installed and set up
- Purchase points and delivery mechanisms as described