UITP — ADVANCING PUBLIC TRANSPORT

SMART TICKETING Alliance

❯ HANDBOOK

TICKETING IN MOBILITY AS A SERVICE

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INTRODUCTION

Ticketing is now viewed as the key enabling transport-user tool of Mobility as a Service (MaaS), going far beyond its initial purpose of gathering revenues. In order to offer passengers a seamless, end-to-end and easily accessible journey, ticketing should enable mobility services to be a combined experience. An experience that is based on real-time information, even during times of transport interference.

Ticketing services must have bold ambitions, based on systems that are well-designed and highly adaptable. This is of course not without its challenges: as new requirements appear, linked specifically to MaaS, the need for ticketing systems to be flexible is vital. Often subject to vendor-locking, ticketing systems currently do not always provide the necessary solutions to the challenges they face.

The purpose of this document is two-fold:

❯ *To deliver an integrated view on high-level implementation-focused elaboration of e-ticketing in MaaS.*

❯ *To guide authorities and operators on how they can integrate the new technologies with existing transport systems/infrastructures and services.*

The outcomes and recommendations presented in this document are the result of several workshops, surveys, and discussions held during 2021 and 2022 with UITP and STA members including public transport authorities (PTAs), public transport operators (PTOs), MaaS mobility organisations and mobility solution providers. Therefore, this document contains a common view of a large number of key mobility players with regard to Ticketing in MaaS, challenges, solutions and actual use cases.

KEY DEFINITIONS

Alternative mode	Any publicly advertised mode of operation different from the conventional mode of operation, in particular vehicle sharing, vehicle rental and vehicle pooling source: CEN prEN 12896-10 Transmodel, Alternative modes, 2022)
Interoper-ability	Ability of (sub)systems to interact with other (sub) systems according to a set of predefined rules (interface) (source: CEN prEN 12896-10 Transmodel, Alternative modes, 2022)
MaaS	Mobility as a Service (MaaS) is the integration of, and access to, different transport services (such as public transport, ride-sharing, car-sharing, bike-sharing, scooter-sharing, taxi, car rental, ride-hailing and so on) in one single digital mobility offer, with active mobility and an efficient public transport system as its basis. (UITP Report Ready for MaaS? (May 2019))
MOD	Mobility on Demand (MOD) is an innovative, user-focused approach which leverages emerging mobility services, integrated transit networks and operations, real-time data, connected travellers, and cooperative Intelligent Transportation Systems (ITS) to allow for a more traveller-centric, transportation system-of-systems approach, providing improved mobility options to all travellers and users of the system in an efficient and safe manner. https://www.modalliance.org
Media-based ticketing	System whereby a card (or other medium) is used as the travel entitlement, as opposed to a physical ticket. (Demystifying ticketing and payment in public transport, UITP, 2020)
Public transport	A transport service that is publicly accessible enabling a person to either move or to be moved from an origin to a destination based on the use of transport means for collective, shared, and individual use

Note 1: Publicly accessible bus, tram, metro, train and ferry are examples of transport means for collective use..

Note 2: Publicly accessible shared bikes, shared el-scooters and shared cars are examples of transport means for shared and individual use.

(Definition based on UITP report Public transport trends 2019 in ISO TR 4447, Comparison of two mainstream integrated mobility concepts, to be published in 2022). |
| Ticket | Travel entitlement. It is itself at the core of Mobility as a Service, being the gateway to mobility and freedom of movement for all. Ticketing is not just about payment - it must play a key role in modal balance while guaranteeing the revenues that are essential to financial viability. (CNA report Ticketing for MaaS, Best practices for durable systems, 2020) |
| Token | A secure medium used to pay and as entitlement (to grant access) for products and services, for example, a smart card, smartphone, NFC token etc. |

SETTING THE SCENE

The MaaS ecosystem is often seen as a playing field, a game with rules, and players in this field (actors, stakeholders). Regulation can enable cooperation if it sets some borders for freedom in order to prevent unfair competition and to promote cooperation. If an optimum space is left for mobility partners to make their own free decisions, this contributes to trust of mobility partners. For Transport Users too, clear rules and guarantees help to trust and to push them out of their cars via MaaS solutions.

Integration is key to classify the different MaaS initiatives and services provided according to the different layers of integration achieved.

Figure 1: MaaS topology with levels 0-4 describing varying levels of integrations as presented by Sochor et al. 2017[1].

The highest integration level is based on societal goals, through policies and incentives. A well-integrated mobility ticketing solution covering all mobility partners in a region and beyond regions is particularly key to deliver a more sustainable "mix" of mobility options that would make it seamless for people to have more sustainable mobility patterns. An example of incentives can be Transport Users rewards/bonus points for using environmental-friendly mobility solutions.

Mobility as a Service features two fundamental components: **information** (users planning how to move) and **access** to services (users actually making the move). In public transport, access to the service is possible through ticketing, while in shared mobility services, access can be based on booking and unlocking a vehicle. The generic term "access" is here the connecting term for use of mobility services. This gives a crucial role to the ticketing, and the related payment, when setting up every MaaS initiative.

> *MaaS should be inclusive and accessible. Services should be available and accessible for ALL, including non-digitalised people, ensuring usability of the systems for all user groups.*

Therefore, enabling inclusive mobility information and access to mobility services through ticketing, together with booking and payment, is an important step to enable seamless mobility and shape MaaS as a tool to steer travel behaviours towards more sustainable modes and achieve more sustainable mobility in our cities [2]

In this report we focus on the access aspect of ticketing and will not treat the aspect of fare collection that is associated with ticketing for public transport. Setting the fare structure for public transport should remain in the hands of the PTA, and private mobility services need to be able to define prices according to their respective business model.

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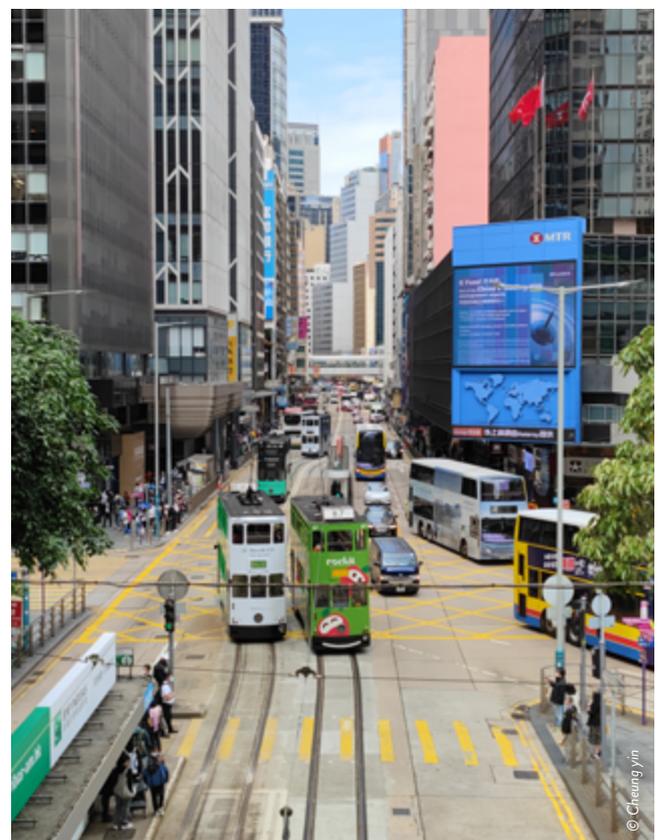
1 Sochor J., Hans A., Karlsson M., Sarasini S., A topological approach to Mobility as a Service: A proposed tool for understanding requirements and effects, and for aiding the integration of societal goals, 2017

2   UITP, 2019. Ready for MaaS? Easier mobility for citizens an better data for cities. Policy Brief.

This document will focus on a number of relevant items and issues with regard to ticketing in MaaS. Three key challenges are introduced in this chapter. At the end of this document, based on research findings and use cases, action direction for these challenges will be indicated.

CHALLENGE 1: EXISTING DIGITISATION GAPS IN TICKETING AT LOCAL, REGIONAL AND NATIONAL LEVEL

Approaches to ticketing in MaaS are fragmented with different, non-interoperable local intermodal ticketing solutions, so the achievement of seamless digital infra-structures will probably be quite complex to realise. The challenge for MaaS is here, to integrate these different existing ticketing solutions – with different suppliers, technologies, operators with different strategies and business models.

CHALLENGE 2: LACK OF UNDERSTANDING OF STAKEHOLDERS' NEEDS AND ROLES

Intrinsic differences between the ticketing process in public transport and the corresponding process for payment and access for most shared & on-demand mobility modes in which the price of access can't be determined in advance (it often is only possible to estimate a price); this makes challenging managing the two different fare/pricing systems for a proper integration. These modes together have a different history and different perspectives, but the challenge will be to connect these worlds in order to create a great, flexible and trustworthy mobility chain. In many regions of the world there is lack of knowledge of the possible approaches and solutions. A clear strategy and working examples on how clearing should be handled is missing.

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CHALLENGE 3: EXCHANGE OF DATA: REGULATIONS, TRUST, PRIVACY ISSUES, COMPETITION ISSUES

The exchange of data is the paramount for the success of MaaS application. Lack of coordination led to data privacy issues, as private mobility operators are not ready to share their data due to high competition among their competitors. On the other hand, PTAs and PTOs are not willing to open their system as there is no business case. Further, there is apprehension about losing touch with public transport users and revenue loss in the long term.

MaaS platforms integrate different means of transport and often also several transport operators, some of which are in competition with each other. At the platform level, therefore, not only technical interaction is required, but also cooperation based on trust and in line with interests of all partners. Each platform or several platforms together need a governance that gives each participating partner confidence, trust and security that it can bring its own business model to success in interaction with the platform and the other partners. In practice, the questions of what such governance exactly looks like and which organisation takes care of this governance are often still unresolved yet.

For a customer centric approach of ticketing in MaaS, it is necessary to consider that **a governance body should oversee the likely volatile market of commercial digital mobility services and deal with malicious practices and customer protection issues.**

To advance digital integration, regulators should encourage and enable local and regional authorities to describe the conditions for resale of publicly-produced, funded transport and infrastructure services, and define non-discriminatory contracts for interested resellers. All while keeping management ownership of the data.

Different stages of regulations and different governance models can be applied according to the regional and local context. In some regions of the world, transport authorities do not control how private entities deal with Transport Users. In other models, PTAs do have a right to control how private entities deal with Transport Users as:

- It is their responsibility, in the end, to ensure Transport Users arrive at their destination
- They are the ones that set out the public policy goals and transport plans for citizens
- They often end up dealing with the complaints of dissatisfied Transport Users

CLEAR ROLES AND RULES

MaaS means cooperation of a number of different players in mobility. In order to make this cooperation work successfully, all parties involved need to know their own role and what they can expect from the other players. This leads to working together on a basis of **agreed rules and supporting regulations.** Such clarity in cooperation strongly contributes to **trust of all mobility parties involved.**

A decisive step towards the set up of a fully integrated mobility strategy that prevents from fragmentation of the market is highly desirable. **Clear roles, rules and responsibilities have to be defined, agreed and governed** between cooperating partners in MaaS and are designed with inclusivity in mind: inclusivity of all Transport Users, and inclusivity of all partners large and small.

In a number of countries, **standards are used as a basis** for roles, responsibilities and business rules. One examples here is a standard like ISO 24014-1, implemented in countries like United Kingdom, Germany, France and Japan.

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3 See Joint Opinion on EU-wide integrated ticketing by UITP, EMTA and Polis

Business roles

- **Mobility Service Provider (MSP)** are Mass transit providers (bus, metro, rail), taxi, shared mobility providers (bike sharing, car sharing, scooter sharing, etc), on demand transport, car rental. They can be public or private.

- **MaaS Operator** is a digital operator that, through a single front-end, conveys multiple mobility services to end users in a seamless multimodal way. The MaaS Operator handles end-user requests for mobility, providing customer support, handling payment and managing how to distribute the fees across all MSPs through a compensation engine.

- **MaaS Integrator** plays a role of transport software integrator, with the mission of putting to system various transport services for one or more MaaS Operators. The MaaS Integrator integrates data and services from all MSPs and creates multimodal value-added services for information, planning, booking, payment, and travel support, making them available to MaaS operators via suitable, ideally open and standard interfaces.

- Role of Transport Authority

In the European Union: in the context of the EU's "Green Deal" and general strategy to reduce CO_2 emissions, organization, management and control/monitoring by public authorities of public transport is of great importance. Since transport systems are to be organised at the urban, suburban and regional levels with the aim of reducing the transport environmental footprint and traffic congestion, transport authorities also need meaningful and strategic planning influence on the systems that control traffic flows and thus also on the design of MaaS platforms. In this way, the transport authorities may also set parameters for ticketing and continue to have full control over the fare structure. In many cases transport operators and mobility providers will provide services decided by the PTA as being in the public interest for which they then receive appropriate (financial) compensation[3].

"A long history of public-private sector coordination in the public transport sector has revealed that without an effective governance framework, business interests do not naturally align with sustainable mobility goals, as promoted by cities, regions and the EU. However, market governance based on public-value principles offers an effective means to control undesirable but foreseeable market deficiencies and to inspire meaningful innovation that satisfies business interests and sustainable mobility objectives alike."

In other regions of the World: Regardless of who plays the role of MaaS Integrator and MaaS operator, the public authorities should be equipped with the necessary tools for governing the development of a multimodal mobility ecosystem and ensuring its compliance with public policy goals. As MaaS is still rapidly evolving, regulation and governance should facilitate this evolution and avoid any excessively strict and/or fixed schemes that are based on conventional operational models and roles. Instead, the governance framework, which is often designed and applied at a local or regional level, should ensure that MaaS services deliver on its societal goals, provides user-centric value propositions, and enhances the (economic) viability of the ecosystem. It is of the utmost importance that the governance framework is built in collaboration with and through the participation of the public and private sectors, including all level and relevant authorities, users, existing market service providers, and market newcomers. Last but not least, the framework should always keep the end users in mind. Considering its dual purpose, a regulatory framework should establish such preconditions for developing an open ecosystem of data sharing, integrated services, and fair competition.

MOBILITY AS A SERVICE PLATFORM IN THE GRENOBLE AREA, FRANCE

The territory of the Grenoble region, also known as the "Capital of the Alps", offers a quality environment with dynamic cities surrounded by nature, a rich and varied cultural heritage, interesting professional congresses as well as great sports facilities. It is composed of 49 municipalities and covers more than 540 km².

These specificities make it an attractive territory for inhabitants, students, leisure tourists and professional tourists. Grenoble area represents 450, 000 inhabitants, more than 3 million tourists each year and 1.7 million daily trips.

Grenoble, the European green capital

The mountainous geography of the region crossed by two rivers forms a topography where pollution is retained. To fight against the recurring pollution peaks and excesses of the maximum values recommended by the WHO, Grenoble has undertaken an ambitious plan to accompany residents and users.

Rewarding the long-term commitments in terms of sustainable development, the City of Grenoble was elected European Green Capital by the European Commission in 2022.

One of the best examples of transition is undoubtedly the development of soft mobility. The public transport network is one of the first in the world to become fully accessible to people with reduced mobility, initiating in the 1970s a transformation of public space to create a city suitable for all. Today, the Grenoble area provides a network of 5 tram lines, nearly 50 bus lines, 21 park-and-ride facilities, 450 km of cycle paths, carsharing, carpooling, bike and scooters sharing services. The main challenge is to highlight and combine these mobilities and to give the car its right place in the public space.

Pass 'Mobilités', the MaaS platform

The SMMAG (responsible for the organisation and regulation of mobilities in the Grenoble area), assisted by Setec ITS, has implemented a multimodal and intermodal solution, a MaaS platform called "Pass'Mobilités".

This public platform of mobility management in the Grenoble region, the "Pass'Mobilités", offers:

- Passenger information consisting of an interactive map, a multimodal route planner, waiting times at stops, time sheets and alerts in case of disturbances
- Single sign-on (SSO) to access to all mobility accounts by logging only once
- Account with centralized information management, access to its consumption in real time
- Easy subscription with the sharing of information between all mobility services
- Distribution of tickets and ticketing cards, booking (rental car or carpooling trip), use of the service (unlock vehicle doors, validate a ticket with a mobile phone…), prepayment and postpayment, and a single billing
- After sales services
- Integration of end-to-end services (car parks, carsharing, carpooling…)

Current situation and next steps

The new application was experimented between February 2020 and August 2021. After the first experimental phases that allowed to validate the concept and the interest of users, the app was opened to the public in September 2021, under the name "M Mobilités Services".

The SMMAG intends to continue the development of the platform, with the implementation of new features (employer functions, cross-pricing, bike rental services…), the improvement of the user journey and the optimisation of the application's ergonomics.

The next phases of deployment are:

> Summer 2022: Access to the application on Google Play Store and Apple Store

> Early 2023: Integration of the public transport distribution module

MAAS COOPERATION MODELS

Trust schemes of cooperating partners in MaaS make directions for use by driving forces and cooperation move based on voluntary mutual agreements and common understanding.

Cooperation is possible only in a context of **trust** and with the **sharing of the final goal.** The MaaS goal must be clear and shared by all. More in practice, collaboration is possible if MaaS is **aligned with the business model or public policy goal of each stakeholder.** This is a challenge (but not impossible) to put together private and public interests. Private interests are mainly profit-driven; public interests are mainly service-driven, especially since the public transport market has a practically zero profit margin. Cooperation could therefore be a **point of arrival** rather than a point of departure; **public investment and regulatory action** may be required to facilitate and achieve collaboration.

Ticketing within the different MaaS cooperation models is supposed to be a means/tool to access mobility services and has different scopes and perspectives for PTAs and PTOs, other mobility service providers and passengers. All stakeholders may have a unique position within the market, yet a viewpoint that should identify strong and weak points, opportunities to take yet potential barriers and ways to tackle them for a frictionless and interconnected multimodal experience.

FROM PROJECT TO INTEGRATED MOBILITY NETWORK IN KARLSRUHE, GERMANY

The regiomove project started as a research project in December 2017. The state of Baden-Württemberg and the European Union funded regiomove for approximately €4.9million. Regiomove is a lighthouse project of the TechnologieRegion Karlsruhe and a consortium of regional partners from universities, IT companies, local authorities, mobility providers, coordinates by the transport association, Karlsruher Verkehrsverbund (KVV).

The goal of regiomove is to connect the existing public transport network with new mobility services for the communities in the area. No matter if tram, train, bus, bike sharing or car sharing. No matter if rural or urban. They all become integrated in a network that transforms the public transport network into a mobility network.

regiomove creates real alternatives to motorised individual traffic. New mobility behaviour is supposed to relieve the environment and resource wastage and that is the basis of the ecological traffic turn: Intermodal, digital and regional.

What was implemented?

The regional cross-linking is carried out using two fundamental components: The Ports (hubs) and the App. regiomove Ports are real-world places where people can easily connect their journey with tram, bus, shared bikes or cars. Such combined journeys are digitally connected via the regiomove App. With only one single account, customers can route, book and pay intermodal journeys. Furthermore, the Ports may offer new service components,

like digital information terminals, charging stations, locker boxes or bicycle service stations. The connection of Ports and App, of digitalisation and infrastructure, establishes a layer of new mobility experience.

Launched in November 2020, the regiomove app provides a single sign-on experience for the user. It allows information, booking and billing of all modes of transport within the app. Personal preferences and real-time traffic data ensure the user finds the best option. The legal framework enables public and private transport companies to remain independent while cooperating.

Regiomove is operated by a public institution, ensuring that public interests are maintained. The project does not simply focus on Karlsruhe but connects urban centres with rural communities throughout the entire Region of Middle Upper Rhine, enabling urban-peripheral journeys. As mobility demands do not stop at regional borders, the regiomove platform is designed to connect to other regional platforms and can be used as a blueprint for other regions.

MaaS ticketing and payment approaches

The legal framework and the IT architecture create an Open Platform. Already public and private mobility services are included, yet further mobility providers can be connected. Regiomove is also easily scalable and transferable to other regions and transportation associations. The neighbouring region is going to be connected in 2022, enabling not only intermodal intra-regional, but also inter-regional mobility.

The current situation

The regiomove app serves thousands of active users every day. Modular mobility hubs – called 'regiomove ports' – are being finished in 2022. The multimodal mobility modes are combined to fit the specific needs of each location. Ports (hubs) will successively follow. The combination of app and ports and their physical-digital interaction establish a regional identity and visibility of new mobility that is crucial for changing everyday mobility habits.

BUSINESS MODELS

MaaS Operators offer services directly to the users operating mainly from a B2C (Business to Consumer) type with services aimed at individual Transport Users, but also B2G2C (Business to Government to Consumer), or B2B (Business to Business) with services for businesses.

The MaaS Integrators operate both from a B2B (Business to Business) perspective, offering system integration services to MaaS Operators to allow the provision

of MaaS services, and from a B2G (Business to Government) perspective, offering system integration services useful for public/collective purposes, as enabling elements (necessary but not sufficient) for the development of MaaS services. In general, **the value proposition of MaaS Integrators is increasingly orienting towards public rather than private Transport Users.**

As regards the business model for the remuneration of the services offered, the MaaS platform (both MaaS Integrator and MaaS Operator) can request the client a fee (or commission) on the payment for access to a transport service. The amount of the fee may be different between MaaS Integrator and MaaS Operator. In the first case, the fee can be agreed in advance and serves to cover the operating costs of the platform. In the second case, however, there is greater entrepreneurial freedom, especially imagining that the MaaS Operator can propose packages (or bundles) of tariffs or, in general, can sell aggregate and integrated mobility solutions, with a potentially higher final commission than that deriving from the sale of single unimodal travel tickets. This freedom is necessary to cover the costs of acquiring and managing the end users of the service, first of all customer assistance[5]. Additional business models could include the payment of a fee to access real-time information.

The **interests of public service and commercials should be put together in win-win solution.** PTAs and public and private operators are interested in running a financial sustainable business, that may require/need public funding to provide such non-profitable mobility services.

MaaS has not yet demonstrated a viable business model leading to profit for the parties involved. Part of it is due to the fact that a large component of a MaaS system is public transport. Public transport is about providing services and about helping achieve societal goals, such as accessibility, inclusivity, environmental health and sustainability. Because of that it often requires public
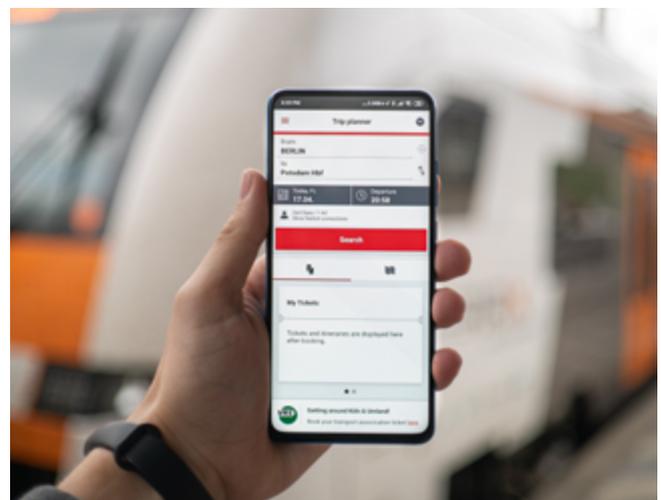
5 MaaS Guidelines, TTS Italia 2021

subsidies in order to function properly. Considering the dependence of MaaS on Public Transport, for MaaS to function properly, **subsidies are also required, particularly for setting up and operating the public components of a MaaS infrastructure.**

Furthermore, to demonstrate their effectiveness, MaaS projects should be able to act on mobility behaviors and activate several levers, including the financial lever through the economic interest of the choice of modes or through incentives. Therefore, it is necessary to cross the threshold of experimentation and have feedback on a large scale and over a significant period of time (not enough hindsight for the moment). The readability of the price offer is essential, between packages that are not always included and pay-per-use at the best price (which needs to be explained).

ACCOUNT-BASED TICKETING AND MAAS ECOSYSTEM IN THE PROVINCE OF TRENTO, ITALY

The province of Trento is an extensive area on an inter-urban scale, consisting of more than 200 small and medium-sized municipalities within a vast and mountainous territory. In total, there are 550,000 inhabitants with 5 million tourists visiting each year.

Public transport covers multiple modes, operated by several agencies under public authorities. The quality of public transport is very high, both in respect to national standards and the European average. New technological solutions must therefore meet these high standards.

The users are a mix of residents, students and tourists, given the vocation of the capital as a university city and of the region as a tourist destination both during the summer and winter months. For this reason, transport must be multilingual, with Italian and German spoken by the local population and a range of foreign languages for tourists.

What was implemented ?
A MaaS platform called "OpenMove" was implemented in 2015 with an Account-Based Ticketing (ABT) system and integration of various transport services in the territory. Travel planning, maps and timetables in the entire Province of Trento are available from multiple transport service providers and mobility stakeholders.

The current situation
OpenMove has become the digital sales channel for all mobility services in the region, with 2.5 million trips per year performed through the app. This covers urban buses, suburban buses, trains, cable cars, taxis, parking, limited access areas (Sella Pass) and skibuses.

The MaaS project has been active since 2015 and brings together transport authorities, touristic stakeholders, political administration, decision makers and educational institutions.

Tourists benefit from a dedicated mobility bundle in which bus and train transportation is free for the entire duration of their holiday and students have an annual pass which guarantees unlimited access to transport in the region. As a result, 65% of tourists in the region use the app to travel and 90% of university students use the app instead of the smart card.

OpenMove provides transport authorities with collection tools and web dashboards for the management of the ticketing system. They can benefit from lower distribution costs, saving €10 for each student who uses a smartphone subscription instead of the smart card. Plus, the app relieves the work of ticket offices since users can autonomously fetch information and tickets. Authorities can communicate with users in real-time without language or currency barriers.

MaaS ticketing and payment approaches

The MaaS platform is completely managed by OpenMove, acting both as a MaaS integrator and operator. The OpenMove Suite is composed of:

- ❯ OpenMove WAY (app for end users to find information - thanks to an intermodal journey planner - and purchase tickets)
- ❯ OpenMove ACT (app for field personnel, the tool for inspectors and sellers)
- ❯ OpenMove ATLAS (web dashboard that allows a complete management of the MaaS offer)
- ❯ OpenMove NUCLEUS (backend engine that orchestrates all operations and data between the different modules of the Suite)

With ABT, the mobile channel is compliant with ISO/TR 20526. As for payments, an in-app digital payment system is provided by external payment providers using a one-tap-pay approach.

Business and financial models

The whole service is financed by a 10% fee on sales. The value is higher than the Italian average but allows for quality work and is in any case lower than the savings of the public administration which, to further incentivise public transport, grants end users a 10% discount on digital channels.

EXPERIMENTING WITH RURAL MAAS IN TOUHOKU, JAPAN

April-September 2021

While Japan's public transport system is the envy of the world, outside of the densely-populated urban areas can be very different. In many areas, transport is declining and operators are struggling to find alternative solutions for efficient sustainable mobility, especially with the ageing population.

JR East is a railway company whose operational area covers the eastern part of Japan, including northern Japan. Interested in developing rural MaaS, the company is conducting pilots in various areas focusing on MaaS business models linked to tourism.

What was implemented?

JR East created and piloted an integrated platform for payment at restaurants and stores, a DRT system, and ticketing in the Tohoku tourism area. Users were able to purchase tickets and make payments at stores using one system on their mobile phones. The DRT service was also provided for traveling between tourist attractions, reducing the need for travellers to travel around the region with their own car or taxi.
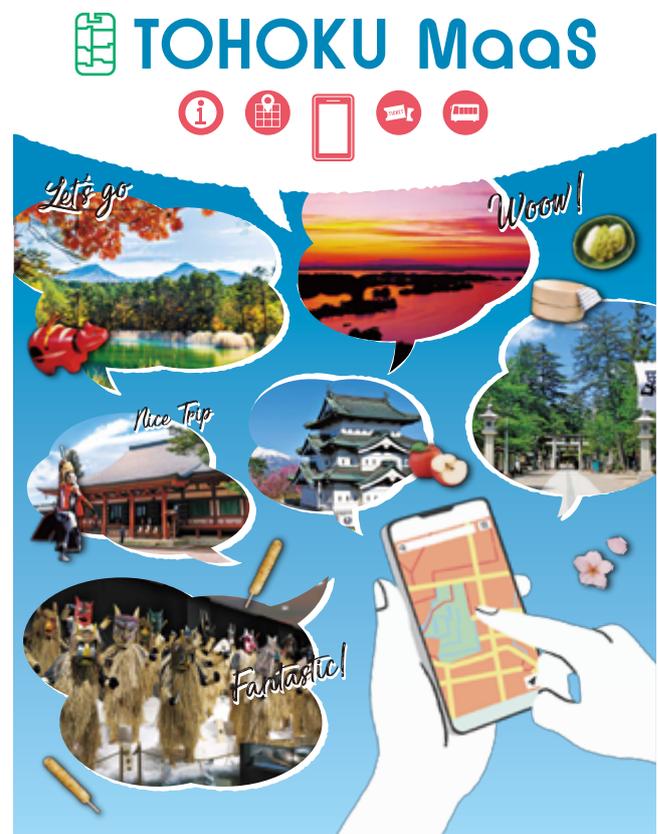
MaaS and payment approaches

▶ Travel planning services: This function allows users to build their preferred travel plans based on model courses and other information. Add destinations of their choice and the travel time is automatically recalculated, making planning easy.

▶ On-demand transport services, reservation and payment (Licensing pending)

▶ Purchase of various transport tickets and sightseeing tickets

▶ Reservations and payments for reservation-based express buses and scheduled sightseeing buses

▶ Ekitoma Ticket: Electronic tickets are standardised across all areas

The current situation

While the pilot offered a solution for rural mobility, it was not a viable business solution unless there was constant demand from the tourism sector so far. There were more passengers than expected, but DRT is especially difficult to generate revenue without state or government subsidies. Although the pilot originally intended to end after six months, JRE has resumed service to explore the further possibilities for local passengers

In addition, JR East will continue to establish use cases through pilots in other regions.

TICKETING AS A MAAS ENABLER

TICKETS OFFER ACCESS TO MAAS MOBILITY OPTIONS

How to define ticketing in mobility? One definition that fits quite well to the focus of this report on ticketing in MaaS is the following: *Ticketing exists due to the need to establish a contract between passengers and transport operators but also because transport is not a good that can be purchased like any other good in retail; ticketing is the gateway/access to mobility and the possibility for all to move about*[6].

Ticketing gives access to the transport services through several functions: information, booking, fares, physical access, payment and control [7]

A ticket is typically related to public transport. Other mobility modes may have other ways of making reservations, payment and control. In a number of cases, after booking a service, the transport user receives a "right to access" and can then use a bike or scooter, for example.

© Nextbike

Ticketing in public transport is changing now in a number of environments as traveling with a right to access based on Fare media used as a single identifier (ID) is implemented in a number of Account-Based Ticketing (ABT) architectures, for example. The ID, also named as token, is associated to a **travel account** where a transport service contract is registered. At each tap of the fare media, the ABT system process registers the travel event and validates the right-to-travel. Long distance transport follows developments in new ways of ticketing that airlines introduce. And in some cities, like London, transactions with contactless bankcards are used as right to access.

Because of these developments, all based on making use of possibilities with digitisation, the term "ticket" can only be broadly defined, taking new developments into account.

Ticketing is a great enabler of MaaS. As it is a crucial precondition for both transport users and mobility partners that their needs are fulfilled as well as that they trust both MaaS and ticketing in MaaS, **the enabling potential of ticketing in MaaS is strongly related to trust of all involved parties in ticketing in MaaS:** they can have an actual insight in their information flows, can share information in (near) real-time according to agreements with their partners and can flexibly adapt tariffs and other parameters while making optimum use of back-office systems that, in an interoperable network, can be enabled to communicate with other back-office systems with mobility partners.

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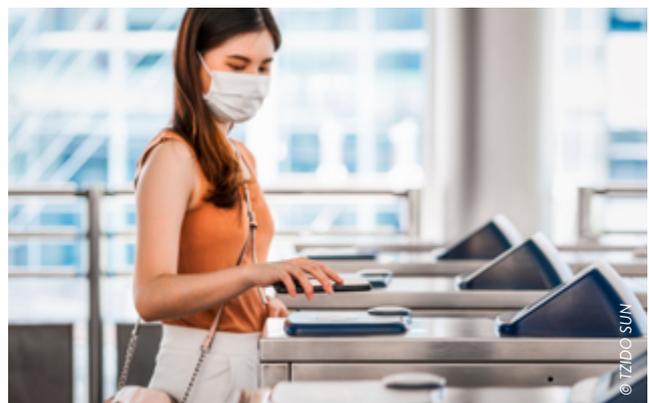
6 UITP report – "Demystifying ticketing and payment in public transport" (2020)
7 MaaS Guidelines, Club Italia 2021

A NATIONAL APPLICATION FOR SWITZERLAND'S SEAMLESS PUBLIC TRANSPORT

The central European country of Switzerland is connected by an extensive public transport system which appeals to both residents and visitors to most corners of the country and beyond to other European destinations.

But with a wealth of options comes confusion. In Switzerland, passengers had to buy tickets and passes through various channels before their journey: counters at stations, TVM, online and through different apps. cations. It was laborious to find the optional offer that covered the networks of the different operators.

Since the late 1990s, the Swiss public transport industry discussed the introduction of a nationwide card-based tap-on, tap-off or Be-In, Be-Out System (BiBo). However, all proposals failed due to cost and complexity reasons, given the enormous hardware infrastructure that would have had to be built.

What was implemented?

In 2015, FAIRTIQ's founders asked the question: How close to BiBo do we get, without ANY hardware in vehicles and/or stations? The result of these reflections was the FAIRTIQ app, launched in April 2016 in three regions in Switzerland and quickly expanded in March 2018 to a national level.

With just one swipe, passengers receive a valid travel permit on the phone allowing them to travel nationwide in Switzerland with all types of public transport (railway, tram, metro, bus, ferry, and even cable cars). On completion of the journey, which can be multi-leg and multi-operator, the passengers are charged the right price for the journey undertaken, optimised across overlapping local, regional and national fare products.

The app uses artificial intelligence-based bespoke algorithms, drawing on many years of experience in public transport and ticketing to build a highly accurate picture of a user's journey, making the app both accurate and reliable. FAIRTIQ's app can be brought into operation quickly and with minimal disruption, as no on-vehicle or on-station equipment is required.

MaaS and ticketing approaches

FAIRTIQ is a post-paid ticketing app: an end-to-end Automated Fare Collection system. The organisation aims to offer the same user experience as smartcard/NFC systems, without the dependency on hardware. Generally, mobile ticketing applications offer pre-paid ticket purchase, the same as ticket vending machines do.

This has made it much easier to implement as the software is fast to deploy, offers greater flexibility and has a low operational cost.

With options such as daily, weekly or monthly capping, users can enjoy public transport without caring about which ticket to buy. At the end of the day, they pay the right price no matter how much they travel. FAIRTIQ also works closely with operators to design promotional campaigns aimed at onboarding users, getting them to use the app again and again, and encouraging them to return if they lapse.

Current situation

FAIRTIQ is an innovative mobile ticketing system that eases the experience of travelling on public transport. The app allows users to check-in and check-out rather than buying a ticket from the driver, at a TVM or a booking office.

While it took some time for FAIRTIQ to make operators understand the value of post-paid services, FAIRTIQ has now processed over 60 million journeys and is increasing rapidly. As well as covering the whole of Switzerland, FAIRTIQ is expanding rapidly in Germany, Austria and France, with recent new projects in Belgium the UK and Denmark.

The feedback from the passengers is that the user experience is excellent; the app is easy to use, they can be confident they are charged the right price and there is no more queueing at TVMs or counters. The operators like it as they can save money by removing TVMs that are not used any more.

Switzerland has leapfrogged the card-based Tap-on, Tap-off model and saved millions of francs by not installing ticketing hardware that would have become redundant for modern BIBO systems.

© FAIRTIQ
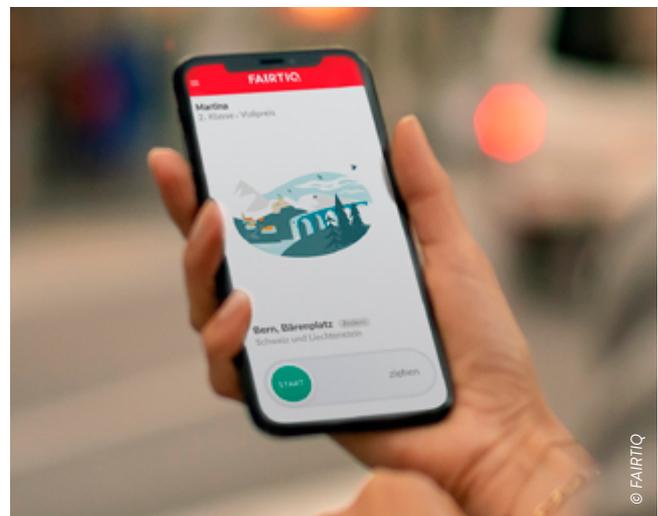
INTEROPERABILITY AS A PRECONDITION FOR MAAS

To establish interoperability, organisational interoperability comes first and technical interoperability follows.

Organisational interoperability is the major challenge as mobility partners have their own goals, governance models, business models and these need to be aligned in good cooperation

Goal of organisational interoperability: mobility partners have trusted open and integrated platforms for the planning, retailing, distribution and ticketing covering all mobility services. Many MaaS concepts contain the mobility platform concept. And here, trust issues come in, for example the fear of losing the customer intimacy, a sensitive challenge that must be addressed to fulfil needs.

"Without organisational interoperability, cooperation in mobility comes to a grinding halt"

When organisational interoperability is established, **technical interoperability** can be arranged. Depending on the level of digitisation and needs for change to adapt to common MaaS solutions, benefits of MaaS could be a challenge for mobility partners. This presupposes that cooperating parties allow for such interoperability by means of not protecting access to their system components (security interoperability) but offering access and exchange of information based on agreements made with regard to rules, roles and responsibilities.

Functional and technical requirements in transparent specifications are a basis for trust and focus on smart ticketing interoperability and seamless mobility. Finding common solutions with a huge installed base and investments for a large number of mobility partners and new partners-to-be without such an infrastructure are, in fact, both part of the organisational and the technical challenge.

One promising solution for solving scalability and interoperability challenges is Account Based Ticketing. ABT can serve as a technology that is capable of creating a **meeting point between different services** to win the MaaS challenge of integrating multiple transport services into a single mobility service. This can be realised, even with completely different traveling concepts, via an interoperable network and an interoperable router.

Certification is important: as it is essential that Transport Users and mobility partners can be confident in the quality of the proper working of system components. It is important to realise supplier independency by cross-testing and certification on standards. Certification is the appropriate means to give trust for all mobility parties involved.

🔍 MAAS ECOSYSTEM FOR A BETTER CUSTOMER JOURNEY IN SALVADOR, BRAZIL

The city of Salvador is one of the largest state capitals in Brazil, based on a huge urban with an area of 693.8 km² and a population of around 4.5 million inhabitants. The region is also known for its natural beauty, historical value and cultural diversity.

The city has experienced a big evolution in terms of infrastructure. The public transportation faced a huge transformation in the last decade. Growth trend is expected to continue as new projects are still being implemented in the urban area. In 2013, a new metro system was launched within a Private-Public-Partnership (PPP), that led the CCR Metrô Bahia to operate and control over 30 years based on the contract concession.

Around six million tourists visit Salvador every year and the city is one of the most attractive destinations during Brazilian summer. To meet the demand of tourists and residents, the city must reinforce the strong public transport infrastructure.

What was implemented?

Since MetroBahia started its operation in 2016, a new ticketing platform was implemented in order to integrate all the public transport services in the metropolitan area, promoting a better integration of Salvador and the nearby cities. The solution allowed the population to travel longer distances, paying only one ticket fare even when transferring from one modal to another. The change increased both the efficiency and usage of the public transport system. Studies show an average time saving of around 30 minutes per trip since this system was implemented.

© CCR Metro Bahia

The company has designed a clearing house system to support the transport fare ticket collection system. This brought a huge contribution to the convenience of the passengers by enabling the use of any mifare cards in all the public transport operators. Not only passenger convenience, but the solution also aimed to increase usage and enhance performance.

The current Situation

The CCR Metro Bahia has been a leader for new technologies and development of ticketing solutions in Salvador. Some results achieved so far:

❯ 10% of tickets sales coming from apps and wallets.

❯ Reduced the regular cabin sales to 22%.

❯ Cut ticketing costs by 23.33% in the last year.

❯ Paper money reduced 34% since the 2020 app launch.

The mission is: "We take care of your journey, so you can live better in your way". Then, focusing on providing a better customer journey and travel time, the company is preparing to implement EMV and electronic transitions similar to the SWIFT system in the Brazilian currency. This is a huge milestone for "a MaaS experience", and the CCR Metro Bahia is expected to contribute to this implementation in 2022.

Ticketing in MaaS Challenges

As a metro operator, the company has the challenge to interface with all the players in the public transport in order to implement and integrate those new technologies. In the first implementation phase the new platform will be used only for the Metro, to firstly understand the risks and how it will work connected to the regular ticketing system. Afterwards, the plan is to expand to other operators. After this expansion it will be possible to start eliminating the mifare ticket.

Another challenge, it's a digitalisation of the customer experience. It will be needed in order to implement the platform in MaaS and it will be important to know the passenger needs.

Understand the future benefits

The benefits of a MaaS platform are already known, based on experiences faced by other cities, such as a better customer journey, new opportunities to improve the metro service and payment methods.

MetroBahia strongly believes that this new project will promote better solutions for the Metropolitan area of Salvador. The implementation of MaaS will enable several enhancements such as avoiding queues, better user experience and new business models for the company. This is aligned with the main mission of taking care of the customers' journey, so they can live better lives.

INTERCONNECTING TICKETING SYSTEMS

With regard to MaaS, one key requirement is the possibility to access all mobility services via one access point. Therefore, whatever the chosen MaaS architecture is, all mobility service providers should allow usage and sharing of data and some functions to enable this. Mobility partners agree on how to cooperate and regulation is needed to enable such cooperation and enabling fair competition including rules for, for example, fair ways of reselling of mobility services.

Interconnecting ticketing systems means enabling access to all mobility services via one access point. However, ticketing systems cannot be opened as well as we do with transport data (timetable, real time information) because it implies many aspects than must be contracted: fees, relation with Transport Users, assistance, refund procedures, claims management, ticketing technology, controlling, fines management, etc.

An "open" and scalable ticketing system means the capability to integrate technologies (smart card, API, data model) without IPR restrictions and that an "Identifier" (ID) associated to the purchase of the right to use a specific mobility service can be transmitted across

different levels within a MaaS architecture, e.g. from a public transport issuing the ticket to the MaaS operator. This "Identifier" has to be such that:

- ▶ It can relate to an invoice, to demonstrate the form of payment, for all stakeholders participating in the ticket sales/transmission process, for invoicing, clearing, etc.

- ▶ It can be validated and/or checked by a human and/or machine for enforcement purposes

- ▶ It can be checked for authenticity (not copied or manipulated) to prevent fraud

- ▶ It is compatible with many existing standard ways of selling, validating, and controlling tickets.

- ▶ The requirement to open, i.e., to transmit access to a given means of transport across a MaaS platform relates to all different MaaS transport modes. This enables interoperability, i.e. the ability of devices or systems to process data in the same way.

APIs, Application Programming Interfaces for mobility, can serve as standard access points for all mobility partners, having the **same data formats** and thus avoiding the need for ticketing system owners to multiply developments in order to connect with other parties. APIs allow the **monitoring of access to and securing of the whole system.**

" Opening ticketing systems will come with a cost. Fair distribution of compensation for investments to be made clearly contributes to trust of the cooperative partners. "

© Dodzy

ACCOUNT-BASED HYBRID-LOOP TICKETING IN MTA, NORTH AMERICA

New York is the largest and the most populous city in the United States. The Metropolitan Transportation Authority (MTA) is responsible for public transportation in the New York City metropolitan area.

As North America's largest transportation network, MTA serves a population of 15.3 million people across a 5,000-square-mile travel area surrounding New York City through Long Island, southeastern New York State, and Connecticut.

The MTA has multiple subsidiaries: Metro-North Commuter Railroad Company (MNR), Long Island Railroad Company (LIRR), New York City Transit Authority (NYC-TA), and MTA Bus Company (MTA Bus), each an operating agency. The MTA provides around 2.6 billion trips each year, over 11 million passengers on an average weekday.

© MTA

What was implemented?

Since 1994, the MTA has been using MetroCard, a magnetic stripe card, to check in passengers. In 2019, the contactless payment technology, One Metro New York (OMNY), was launched with an open payment system. Users pay and enter by simply tapping a contactless credit, debit, reloadable prepaid card, mobile phone or a wearable device.

New equipment includes modern fare validators and configurable ticket vending machines across the MTA's 472 subway stations and 6,000 buses. The contactless payment system offers a simplified user experience by removing the need to wait at a vending machine or at a station booth. Furthermore, contactless payments could shorten bus boarding times and facilitate boarding, making total trip times shorter.

The MTA had to redesign its payment system to be account-based, by allowing each passenger to maintain an individual digital payment account. The MTA has installed near-field communications payment terminals and optical scanners throughout its network.

This transition has several phases: The first step is to enable open-loop payment, allowing customers to use their own fare device; then to introduce a physical OMNY card, but out of system; finally to install new, configurable vending machines in stations. This maximises the user experience and minimises the production and distribution costs associated with the closed-loop OMNY card.

The current situation

OMNY is already available at all 472 subway stations and on all MTA buses. The MTA has scheduled to include Metro-North Railroad and Long Island Rail Road into OMNY and retire the mobile platform eTix for commuter rail users.

OMNY currently only supports full adult rate pay-per-ride. It will soon roll out fare capping and discounted rates, including rail ticketing, student fares, special programs, which are available through MetroCard.

In February 2020, prior to the COVID-19 pandemic, about 150,000 trips per weekday were made with OMNY transactions, out of 8 million total daily trips. Of that number, around 70% of OMNY payments are by mobile phone, with the remainder by debit or credit card. In November 2021, 23% of subway and bus riders used the OMNY to pay for their rides.

MaaS Ticketing and Payment Approaches

Customers can choose how, when and where they pay for their fares. The MTA has introduced the OMNY card to support customers who prefer to fund fares with cash. The MTA will release a new OMNY app which will provide seamless fare payment between LIRR and MNR services, subway and bus services.

Although no account registration is required, an OMNY account gives transit users access to a secure, personalised dashboard, where they can view 12 months of trips and charges, manage payment methods and account, contact customer service and much more.

Business and Financial Models

In the early 2000s, the MTA ran trials of contactless payments in several subway stations. These pilots led to procurement of a near-field payment system. The MTA in 2017 entered into a contract with Cubic Transportation Systems to roll out OMNY. Cubic Transportation is responsible for the design, integration, supply and implementation of the new fare payment system. This includes platform hosting, hardware and software maintenance, and customer service support. Cubic signed a licensing deal in 2016 with Transport for London (TfL) allowing it to take the technology developed for London to other cities.

ACCOUNT-BASED-TICKETING: A PROMISING WAY OF TICKETING IN THE MAAS CHAIN

For users, the car remains very convenient, flexible and easy to use[8]. Ticketing and getting access to modes of transport is sometimes challenging as per it is unfortunately too fragmented at regional level and is often considered as complex: ticketing solutions that require purchase of smartcards or paper tickets, a diversity of tariff complex structures, with only prepayment, are, in fact, often an obstacle for travellers whose **journeys require more flexibility in terms of seamlessly accessing sustainable mobility services** by means of decisions made upon travel time, frequency, transport operators, payment, and the guarantee of a fair price.

Account-Based Ticketing (ABT) is **a method of ticketing where the proof of entitlement to travel and any records of travel are held in a back-office** and not in any physical media (like public transport smart cards) held by the transport user.

Account-Based Ticketing has a number of **benefits for Transport Users and mobility partners** and can be used in the entire MaaS mobility chain:

❯ Convenience, flexibility and possibility for Transport Users to use a medium that they possess, like a mobile phone or a wearable

❯ Through the different accounts, all linked to the unique user identity as a common denominator for very different mobility services, Transport Users can access mobility services in the whole MaaS mobility chain

❯ Seamless cross-region/border travel is made possible with secure traveller identifiers (IDs)

❯ Flexible adaptation to Transport Authority policies because of central processing in back-offices

❯ Convenient, flexible adaptation to changes, e.g. in tariffs, from a central mobility operator level including "transport service packs", dynamic fares in case of events, pay per use, price capping etc.

❯ Ticket products that fit to user needs and that can deliver an optimum user experience

Account-based ticketing, like any other ticketing solution has also some **points-for-attention.** Examples here are especially connectivity of the system and securing taps of Transport Users using the system and income of mobility partners. These risks can be solved by way of risk management practices.

It is important that the payment method is very well accepted by the service providers among the MaaS ecosys-

8 The widespread car ownership in the Netherlands, KiM | Netherlands Institute for Transport Policy Analysis (Toon Zijlstra, Stefan Bakker and Jan-Jelle Witte)

tem leading to the readiness of the acceptance network, not so easily achieved with a closed-loop[9] private system. Open-loop[10] payment method can guarantee a wide range of acceptance and more simple to add a new service provider.

OMAN'S APP IS ENCOURAGING THE USE OF PUBLIC TRANSPORT

Mwasalat, Oman's National Transport Company, operates the state's bus services offering City and Intercity services. Mwasalat covers main cities such Muscat and the popular touristic destination of Salalah, in addition to plan in introduction for other main cities. Mwasalat Intercity services also deliver a regular bus service between the most cities within Oman, such as Muscat to Salalah, Nizwa, Sohar and other cities. Carrying a total of 1.5 million passengers with a fleet of 164 vehicles each year, the buses are clean, efficient and used by citizens and tourists alike.

Taxis in Oman are marked distinctively in orange and white stripes. While a pricier option to the bus, their shared taxis offer cheaper alternatives. Alternatively small vans also serve as shared transport for short hauls and they charge per stop-over points just like city bus services.

The need to improve the bus services in Oman was recognised as an important aspect for economic growth and development. For this reason, Mwasalat wishes to become a world class bus transport operator, provide an efficient bus service that is modern and competitive on a national and international level[11].

What was implemented?

In cooperation with LIT Transit, a Ridango Group company and NEC Corporation, Mwasalat launched a multimodal application in December 2021 as part of a larger national ticketing and AVM project in the Sultanate of Oman including 175 vehicles. The project included provision of an account-based ticketing solution, AVM solution and multimodal application for passengers.

The application connects three modes of transport: City buses, intercity buses and airport shuttle services on a national level for a seamless travel experience across the entire country. Apart from a multimodal journey planner, application provides a centralised "one-stop-shop" for all tickets.

MaaS ticketing and payment solution

- Ticketing: Account based ticketing
- Fare policy: Flat, zonal, station-to-station
- Attractive lower fares through the use of mobile App compared to the normal on-bus sale.
- Purchase options (gateways): Local debit card, international credit cards, mobile providers account payments (Pre-paid and Post-paid) and payments through main bus stations
- Trip payment options:
    - E-wallet: trip payment with stored value
    - Purchased fare item

The MaaS application, ticketing service and mobile ticketing backend was provided in collaboration with LIT Transit, a Ridango Group company.

© LIT Transit
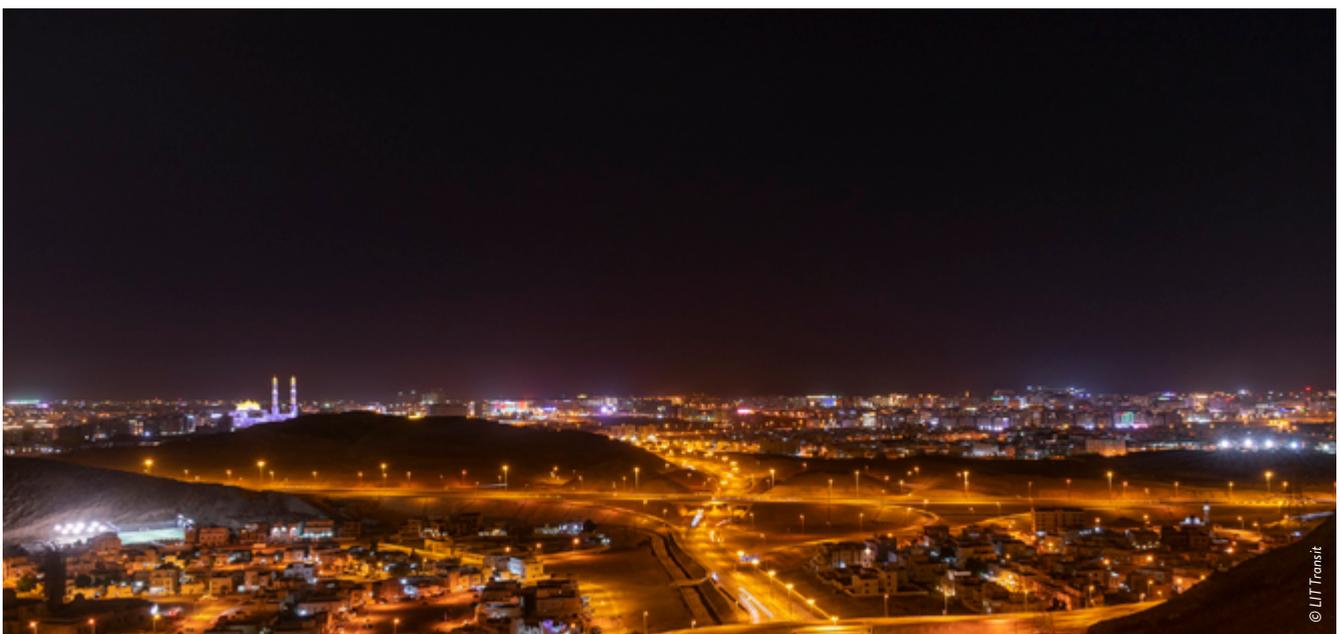
9 Closed-loop: A payment instruments that are used solely for transit purposes. That means, that such payment instrument can be used only for services provided by the transit Authority or Operator and not for generic payments outside transit. (UITP report – "Demystifying ticketing and payment in public transport" (2020))
10 Open-loop: in transport, an open-loop payments generally refer to the use of bank-issued contactless credit or debit cards (or other payment instruments), which can be used for generic payments also outside of transport system. Source: UITP (2020). Demystifying ticketing and payment in public transport. Report
11 https://www.ineco.com/webineco/en/what-we-do/main-projects/master-plan-oman-bus-network

The current situation

While there were certain obstacles:

- Revision of existing fare models to match account-based ticketing
- Introduction of new business processes (e.g., inspection)
- Introduction of new payment channels
- Extension of passenger interaction through mobile application

Overall, the MaaS application encouraged the use of public transport, helped to reduce congestion in cities and provided localised (decentralised) transport services on a regional scale. Users not only benefit from easier travel experiences but, with concessions, benefit also from cheaper services for beneficiaries e.g., special fare prices.

Mwasalat found that a centrally managed system on a national level is cost effective, as a result of service optimisation and performance monitoring. They can forecast for future service demand requirements. Because of the success, the next steps for Mwasalat are:

- Encouraging further utilisation of the new technology through targeted marketing campaigns through various channels
- Introduction of period passes
- Upgrade of intercity bookings
- Integration with other payment wallet providers and self-service city utilities kiosk providers
- Introduction of contactless EMV payments

API INTEGRATION: CONNECTING THE DOTS IN MOBILITY

"Application Programming Interfaces should be central components of a MaaS system as they allow entry points to access functionalities of many mobility providerss"

APIs offer access to data, partly sensitive data. Therefore, to keep **trust in sharing data**, access to APIs and data therefore must be managed according to agreements and regulation: only identified partners, including resellers (working according to controlled agreements) with a need to know can use identified functions and data combined with sufficient security controls.

APIs are independent from a specific transport means. The APIs are not dependent on specific technologies used for the different connected mobility systems. APIs are technical solutions to facilitate communication between different mobility systems.

The MaaS Integration Layer can serve as the heart of MaaS because it harmonises very different mobility systems, created to be opened externally via APIs. The corresponding Integrator and Operator architecture is compatible with different MaaS schemes.

For the API architecture, a Centralised or a Decentralised approach can be used. Many countries are adopting a centralised approach, for example IXSI-5 for shared cars in Germany and French national access point to transport data to access all French open mobility data at one place. A Regional Access Point (RAP) is also emerging as a good alternative.

API integration

Centralised APIs: In this case, there is a central data point which is part of API platform. The central data point work as nodal system to share real time bi-directional synchronization with the connected backend applications and external partners, through asynchronous integrations.

Decentralised APIs: In this case, API gateway works as nodal point and the required protocol, security and data transformations in realtime. API gateway forward the request to backend application and other external partners.

Source: API Platforms: Centralized vs Decentralized

The MaaS Integrator architecture builds a centralised approach. A centralised approach offers the possibility of exercising the governance of multimodal mobility. In this

case, the role of the MaaS Integrator could be played by the Public Administration or by a consortium/partnership of Mobility Service Providers. In this way, the MaaS platform can be used as an effective governance tool to achieve sustainability objectives in transport in addition to achieving the goal of seamless mobility required by the Transport Users.

Who is responsible for developing APIs? **A trusted party should arrange this,** in consultation with the mobility parties involved. A certification and control procedure could be a good basis. All APIs have to be documented and the respective documents have to be kept to date. **Automatic testing** could be advisable to put in place to every time check the API is aligned with the documentation. Any third party API integration should be qualified and tested by the MaaS Integrator to avoid bad usage and overloading of the system.

An **open and modular solutions for ticketing** should be used, according to the following principles:

a. API shall be clearly defined and documented

b. API shall be delivered at the same time as the ticketing system or later if APIs need to work with or to be adapted to arlready existing ticketing systems

c. API shall rely on open standards

d. API shall be tested to prove functionality and performance even if not to be used for the moment

e. Customer management shall be shared at regional level, i.e. one single customer account shared between MSPs

UNICOCAMPANIA - THE REGIONAL MAAS OF CAMPANIA, ITALY

UnicoCampania is a consortium that manages and develops the automatic fare system of Campania Region, with the aim of increasing revenues of PTOs. The Consortium issues travel tickets on behalf of the consortium LPT companies (PTO) and is committed to carrying out distribution, sale and collection relating to ticketing, both integrated and corporate fares.

What was implemented?

A centralised management of ticketing, which were already adopted for tickets on magnetic and electronic media on card since 2003, has been extended to dematerialised tickets in QR format. In 2020, the Consortium activated an integration platform that makes all the applications, the catalogue of saleable titles and, more generally, the mobility and services offer available to all. This created an open and interoperable structure for all operators who intend to connect to the Campania reality.

One such app is the official UNICO Campania App that allows customers to buy integrated multi-modal tickets and passes to travel with public transport services throughout the Campania Region. There are 14 companies belonging to the Consortium. Furthermore, the app shows the timetables of all the companies and organises the trip: by entering the point of departure and arrival, users can see all the options, even integrating fares from multiple transport companies.

The app provides the correct regional fare class between 16 zones and, based on the combination of lines required, proposes the purchase integrated or corporate tickets. Customers can choose between over 500 tickets available (one-way, hourly, daily and monthly).

The current situation

In 2021, during the pandemic, app sales exceeded 1.3 million. In the first 4 months in 2022, there was a growth of 300%. Since September 2021, the UnicoCampania platform and the app have hosted over 120,000 free season pass for students of the Campania Region.

MaaS ticketing and payment approaches

Already being able to count on a governance model that sees the PTO companies at the centre, through the UnicoCampania consortium, Naples achieved first position in the Government selection - MaaS4Italy - to activate 3 MaaS projects in Napoli, Rome and Milan.

In the MaaS project, the MaaS providers integrated into the ecosystem will be:

- Metropolitan and regional LPT on road, rail Maritime lines with the islands of the Gulf of Naples (Ischia, Procida, Capri)

- National operators (Trenitalia)

- Shared mobility operators: electric cars, scooters, e-bikes

- Parking

- Electric vehicle charging infrastructure

- Museums

The Administration will be able to implement active policies, through the creation of tariff bundles aimed at modal rebalancing, equity and social inclusion, creating a level 4 MaaS.

According to the main architectural schemes of MaaS, the Maas integrator's functions have been defined and entrusted to the UnicoCampania Consortium.

Static and real-time data and sales systems will be provided through a regional integration layer at the national layer (DS & SRF) which exposes them to the participating MaaS Operators.
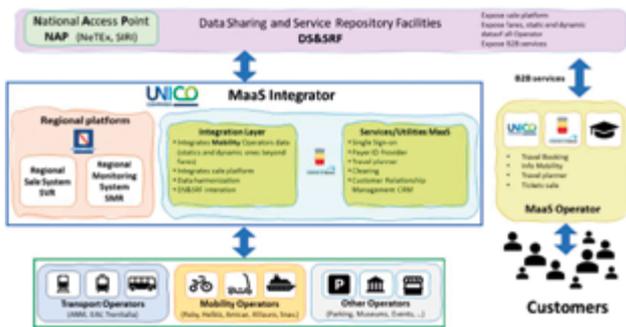
PRIVACY AND SECURITY AS IMPORTANT PILLARS FOR SUCCESSFUL TICKETING IN MAAS

Privacy

Privacy is a key matter of attention as Transport Users deserve to be assured that their privacy-sensitive data is taken care of, avoiding a „big brother is watching me" feeling and impacting customer trust.

Privacy legislation, like the GDPR law on privacy in Europe sets requirements, for example, that no other data other than those strictly necessary should be processed, and that data that can be directly related to a person should be protected according to rules set and checked by the data protection authority.

Communication with regard to Transport Users needs careful attention. Users must be aware that providing personal data (such as GPS position) is necessary to receive adequate services. On the other hand, anonymising and aggregating data should be done wherever possible, also when Transport Users are traveling just with an ID that serves as a ticket to access mobility.

Security

Security is a **key matter for all stakeholders:** systems must be reliable for all, mutual use of data needs to be dealt with on an agreed and transparent basis and money flows must be secured.

Governance, risk management and security controls are essential in order to avoid disruption, loss of money and reputation damage and are focussed on assuring trust of Transport Users and mobility partners.

With the increasing integration of systems and API, cybersecurity audits shall be periodically run to continuously maintain the trust.

OPEN TICKETING STANDARDS FACILITATE COOPERATION IN THE MAAS MOBILITY CHAIN

One of the major challenges in mobility is the reality of fragmented, unique, proprietary and often hard to connect solutions, one reason of this being the **focus on local or regional optimisation.** MaaS requires a **wider view,** a view that still leaves room for local optimisation but also focuses on connecting to cooperation beyond organisational, local, regional and also country borders.

Worldwide and European standards, drafted and supported by many parties in mobility worldwide and Europe-wide, contain good practices and solutions that align different views and focus on effective, stable (and thus: trustworthy) standards, wherever also leaving some room for flexible implementation and local optimisation within a framework that leaves the interoperability goal intact.

Thus, standards greatly facilitate organisational cooperation between organisations (roles, rules and responsibilities), technical solutions, certification and data models that serve as a basis for APIs and data to be used and shared. API and data have to be documented and open to 3rd parties[12].

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12 For some examples of relevant standards, please refer to annexe 3.

OPEN ARCHITECTURE FOR MAAS IN TRIMET, NORTH AMERICA

Created in 1969, the Tri-County Metropolitan Transportation District of Oregon (TriMet) operates public transit services within the Portland, Oregon metropolitan area. Its boundaries are within the Multnomah, Clackamas and Washington counties. TriMet serves approximately 1.8 million residents in 533 square-miles of the urban portion of the three-county metropolitan area. TriMet operates transit buses, MAX Light Rail, WES Commuter Rail, Portland Streetcar and the Portland Aerial Tram.

Public transport is a popular choice in the region with an annual ridership of 99 million passengers. This region is the 24th largest metro area in the U.S., but transit ridership is the 9th per capita. 76% of adults in the region ride TriMet at least once a year.

What was implemented?

TriMet has envisioned MaaS as provision of core transit services to integrate with many other options. In 2010, it initiated a transition from paper-based fare collection system to an account-based ticketing system to offer customers more choice. It would also include rides in adjacent transit systems as well. TriMet named this account-based ticketing system the Hop Fastpass, or Hop.

In contrast to a closed-fare payment system with proprietary software and hardware, TriMet has chosen an open architecture that provides flexibility to integrate modular software and hardware components. Hop's open architecture allows TriMet to remain flexible on changing technologies or falling costs. This choice makes TriMet more freedom in replacing the incumbent fare payment system over time.

Open architecture means to apply open API, open data, and open standards. It empowers transit agencies to adopt plug-and-play modules for specific technologies.

This is a strategy to avoid using a single vendor to provide all software and hardware components. It creates a seamless transit payment experience with multiple vendors providing the website, vending machines, back-end system and so on.

The current situation

Hop has delivered an account-based, contactless, regional fare collection system with features like open architecture, stored value, open payments, and virtualised smart cards. TriMet uses the open architecture to recruit multiple suppliers for a list of services.

- Init: System Integrator, APIs, back office and validators
- Moovel: Apps for account management and fare inspection
- Ready Credit: Integrated with the gift card retail networks
- Scheidt & Bachmann: Ticket Vending Machine
- The Bridgade/Marathon: Websites
- Trapeze: Paratransit
- Trimet: Ticket Office Point of Sale
- Apple & Google: Virtual Card

Since its launch in the second half of 2017, Hop is gaining popularity with travel users. By the end of 2018, 20 million trips were paid by Hop. In May 2019, almost 8% of Hop users paid with a virtual card, and over 7% paid with contactless credit or debit cards, where the remaining 85% paid with a physical Hop card.

MaaS Ticketing and Payment Approaches

Hop replaced a zone-based fare system with a flat fare. Hop made it easier to develop new technical solutions for transit payments. Hop offers transit users multiple benefits: fare capping, auto-loading, monthly passes and concession fares, whether they pay by credit card, smartphone virtual card, or a physical smart card. The smart card option is important for users who prefer to fund fares with cash.

Users of both physical and virtual Hop cards can add value online, visiting regional transit ticket offices, making a phone call or via mobile app. Users of physical Hop cards can also add value at more than 500 stores throughout the Portland region that are part of the Hop retail network.

Business and Financial Models

TriMet issued its RFP for a Hop systems integrator in 2013 to solicit open APIs that would enable any vendor

to connect easily to the overall Hop system. APIs are the heart of Hop's open architecture. They guarantee that a function module can communicate with different technologies. The RFP also established that TriMet would pay no additional fees to the systems integrator for future integrations with new technologies. The open architecture platform and software and hardware components built upon the platform would have been delivered through fixed-price contracts.

Hop's capacity for plug-and-play positions TriMet to take advantage of falling costs of individual components like POS tablets and fare validators. The open architecture should have allowed TriMet to future-proof its fare payment system. In case that TriMet wants to add a new technology or to replace an existing one, it just needs to offer its open APIs to a vendor to integrate

MAAS SOLUTIONS MUST BE AGNOSTIC TO THE EXISTING TICKETING SYSTEMS

The sections above describe requirements and characteristics of ticketing systems which can be supportive of successful MaaS solutions. However, it is also necessary to look at the other side of the coin: **MaaS solutions must be agnostic to the existing ticketing solutions, and they are required to work with any existing ticketing system already deployed in the field as far as practically possible.** While a technological maturity of the existing underlying systems is certainly supportive, it is not always feasible, nor financially viable, to upgrade existing ticketing systems in preparation of a MaaS deployment. An effective MaaS solution must be able to **adapt to different existing components and focus on the successful interplay between public transport and the various complementary mobility services.**

🔍 TESTING MAAS APPLICATIONS IN LISBON, PORTUGAL

Lisbon Metropolitan Area is the biggest agglomeration in Portugal, with a population of around 2.8 million people, in which residences and activities are highly centred around the city of Lisbon. Over recent decades private transport, mostly passenger cars, has become the most popular transport mode in the Lisbon Metropolitan Area. With a motorisation rate of 433 passenger cars per thousand inhabitants, a modal share of private vehicles over 50% and public transport below 30%, there is now a strong political commitment to reverse these numbers and promote public transport. An important element of the strategy to address this challenge is the modernisation of public transport and its integration in digital transport networks[13].

13 Shift2MaaS, 2019
14 For more information: www.shift2maas.eu/

What was implemented?

CARRIS, the bus and tram operator in Lisbon, was part of a multi-operator study to test a set of MaaS tools and applications provided by COHESIVE, an EU-funded research project.[14]

The study was part of the Shift2Rail initiative, under the framework of the Shift2MaaS project . The objective was to explore how public and private transport can be integrated side-by-side within multimodal travel for international users. This meant testing MaaS scenarios in real conditions and validating the developed tools by demonstrating the results.

Between December 2018-June 2021, the project tested the following MaaS features:

- ❯ Trip planning
- ❯ Multimodal ticket purchasing
- ❯ Ticket issuing
- ❯ Ticket validation
- ❯ Ticket inspection

MaaS ticketing and payment approaches

The MaaS platform was provided by COHESIVE, and the ticketing system was connected to the operator's existing system using dynamic QR codes. The payment was made using Google Pay, and the ticketing solution was a 2D bar code.

The results

The project allowed Lisbon to test solutions that offer integrated ticketing and information. As for users, they had access to a MaaS application, and the project partners were able to analyse the readiness of the technology.

Several obstacles were identified as ticketing systems were not 'open', meaning that ticketing was not interoperable across regions and with other countries, and an API to validate tickets was not available.

Following from the tests, discussions are still needed around how to integrate ticketing with legacy systems from different operators and with business tools and regulations that vary across regions and countries.

CARRIS continued to work on mobile ticketing, together with other Lisbon operators, notably in the framework of the MOBIL-T project. This project focused on integrated public transport ticketing systems through an API and, as a result, increased readiness for MaaS deployment in Lisbon.

HOW URBAN MOBILITY HAS BEEN TRANSFORMED IN MONACO

Fully committed to the digital revolution through its Extended Monaco programme, Monaco has launched the Monapass mobile application in partnership with the principality of Monaco.
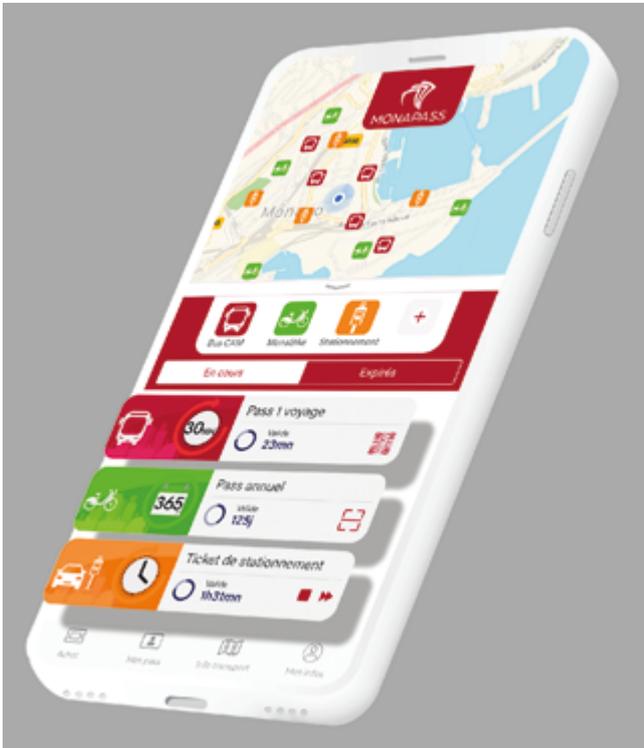
What was implemented?

Monapass is MaaS Platform including an all-in-one mobile application with journey planning, real-time information and an integrated payment system for Monaco's mobility services including:

- Compagnie Autobus de Monaco - buses
- MonaBike - electric bikes
- On-street parking

The current situation

Monaco is continuing its digital transformation by deploying 'Monapass', a new mobility application for users, tourists and commuters. It called on the technological expertise and know-how of Flowbird, who specialise in urban mobility technology, to deliver the solution.

MaaS ticketing and payment approaches

Monapass: A "Mobility as a Service" application provides users with all-in-one solution

Cards, subscriptions and payment methods are integrated into one application, which also provides a range of features including rea-ltime traffic information, bus timetables, bicycle availability and location. The free mobile application allows users to easily and securely plan and pay for their trips via a single ticket, pass, bus or bicycle subscription. For example, users can park their vehicle in the city before using a bus and/or a bike, which can all be booked and paid for via the Monapass mobile application.

In addition to improving the user ticketing and payments experience, Monapass promotes green and active mobility, in support of Monaco's objective of reducing light vehicle traffic by 20% by 2030.

Open Payment: A digital solution for smart mobility

Flowbird's digital solutions allow cities access to easy, fast, safe and secure multimodal and sustainable urban mobility systems. Present in over eighty countries, Flowbird has deployed an optimised its digital offer for Monaco in response to its unique requirements.

Flowbird is also deploying Open Payment on 'Compagnie Autobus de Monaco' bus network, combining ticketing and electronic payments to enable passengers to use their bank card as a transport ticket. The system is also compliant for payments with smart devices such as phones and watches. A tap on the validator with their contactless payment device when boarding permits passengers to travel and to benefit from optimum pricing.

Residents and tourists visiting Monaco can all use this service, allowing them to get the best value fare for their journeys. Open Payments are suitable for everyone and the intelligent system provides daily, weekly or monthly price capping, to guarantee the best value for all journeys.

Business and financial models

Fees are charged per active user and percentage fee on sales.

DATA SHARING

DATA SHARING GOVERNANCE

Transport operators and authorities might feel reluctant to open their data to MaaS Operators, as they see different risks (e.g. in regard of the customer relationship, gatekeeper to all demand and usage data, disclosing the business model, the guarantee of unbiased and independent algorithms, etc). However, **data and information sharing is a prerequisite of any MaaS system,** because an integrated offering must rely on data from the single components, and each single component of the MaaS solution can benefit from being part of a whole.

Not all data can and must be shared among all parties, both because of data privacy issues and because it is important to preserve a degree of protection of the business interests of the single players. Thus it is paramount to **clearly specify which types of data can and which must be shared** among the parties.

In order to achieve a common understanding among parties, it is essential to provide technical and financial support to mobility operators to promote **co-creation for data-sharing frameworks,** through pilots and capacity building.

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DATA SHARING STANDARDS

Interoperability and data exchange are enablers of MaaS, whenever there are interfaces between different parts of a system, which need to be compatible, in order for the whole system to work properly. **Common and standard protocols** have to be defined in order to facilitate the integration of the different Mobility Service Providers. It is crucial to encourage the use of existing standards as much as possible, both the de-facto ones (GTFS, GBFS, GTFS-FLEX, GTFS-RT, etc.) and the bespoke ones (Transmodel with NeTEx, SIRI, OJP, etc.) which, in Europe, are required by National Access Points (NAPs). "standards" are produced by legal official European and International bodies, namely CEN, CENELEC and ETSI at EU level (the ESOs, European Standardisation Organisations) and ISO, IEC and ITU at international level.

15 Refer to UITP MaaS and UITP Demystifying ticketing reports

BUILDING TRUST AND KEEPING TRUST

MAAS IS A MAJOR CHANGE AND A MAJOR CHALLENGE

As soon as the question "Why MaaS?" has been answered and some key goals for MaaS have been set, the next question is: how to achieve these goals?. **Making MaaS move means a big change in dealing with mobility:**

❯ MaaS means a substantial change for Transport Users who now, in many cases, automatically choose for the car if they need to make a trip. A major difference with MaaS is that they will see the car as just one of the mobility options if they want to travel from one location to another.

❯ MaaS means an important change for mobility partners, especially public transport authorities (PTAs) and public transport operators (PTOs), as transport is being governed and delivered with local or regional optimisation in mind. A major difference with MaaS is that, while keeping local optimisation in mind, also a broader view and cooperation with new mobility partners within and beyond local borders will lead to quite different ways of delivering mobility services, new forms of cooperation and different business models.

The major mobility change with MaaS can be prepared with organisational and technical controls as well as attractive new mobility offers for the Transport Users, new ways of cooperation and data sharing between mobility partners and an effective framework of rules and regulations. All these steps to arrive to MaaS and to establish a major change in mobility mean a challenging change for all involved.

HOW SUSTAINABLE, INTERMODAL MOBILITY CAN CONNECT AN ENTIRE COUNTRY

Spain is the European country with the highest number of kilometres of high-capacity tracks in Europe and is one of the world leaders in high-speed rail. However, there are a series of challenges to be faced, such as the need to decarbonise the economy, the digitalisation of the existing infrastructure and transport system and the issues caused by the increasing concentration of population in large cities and peri-urban areas, as well as their negative impact on congestion, pollution and depopulation of the rural areas.

In this context, and with an infrastructure development model that aims to optimise its use and provide effective

solutions for the mobility of citizens, the adoption of MaaS at the scale of the country is a determining factor for the national economy.

Nevertheless, in order to provide a mobility service that addresses these challenges, it is necessary to achieve a collaboration between the public and private sectors. The cooperation of government, public bodies and business will be crucial to provide safe, sustainable and accessible mobility for both Spaniards and tourists throughout the country. Hence, how do we make it happen?

RaaS project: The mobility service that connects the whole Spain by means of a single digital platform

The answer lies in the first MaaS that allows people to move around in a simple and flexible way using more than 30 interconnected transport modes within the entire country , enhancing an economic incentive to use the least polluting means of transport. Herewith the RaaS (RENFE as a Service) project will bring citizens located in the most remote areas closer to the economic hubs. In addition, the RaaS project seeks to reduce the use of private vehicles to improve the purchasing power of its users and allow them to play an active role in improving air quality in Spain.

In this way, the RaaS project aims to face today's mobility challenges by ensuring equity, reducing traffic congestion and helping to achieve environmental and social goals. All this by offering alternatives for door-to-door journeys that enable seamless passenger experience using multiple transportation modes from origin to destination.

Different forms of mobility purchased in a single digital solution

Streaming services have changed the way people search, consume and pay for entertainment media. Mobility underwent similar changes. For this reason, enabled by the integration of APIs, the RaaS project will provide a digital environment to purchase existing ticketing of the different transport providers through a single, digital platform.
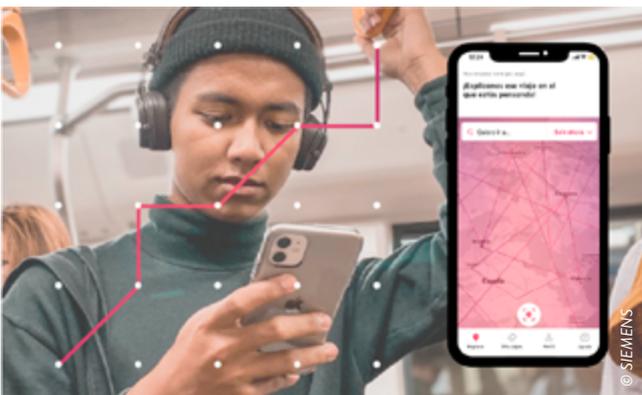
Extensions of the various APIs will provide information on existing tariffs, new endpoints like reservations, beeping of scooters, etc. Consequently, passengers will be able to use multiple modes of transport across the country and purchase all tickets through a single digital solution releasing a one-time proof-of-payment.

TRUST IS A BASIS FOR ACCEPTING NEW WAYS OF MOVING FORWARD WITH MAAS

MaaS can only be a success when masses of Transport Users are willing to choose for mobility with MaaS and when mobility partners are willing to cooperate in offering door-to-door mobility services with MaaS.

This is where trust comes in. Trust is key for sustainable solutions in integrated mobility ticketing within and beyond regions and countries.

Both Transport Users and mobility partners need confidence:

❯ That their needs are fulfilled

❯ That parties in MaaS cooperate and deliver services as agreed

❯ That devices and data processes work according to expectations and regulations.

In addition to this, trust in ticketing also comprises the acceptance of risks: deviations from what is expected may the latter case, confidence is needed that such risks are being dealt with in such a way that quick response in addressing and solving these unwanted events is realised.

Trust for the TRAVELER: choosing for traveling with MaaS is enabled when Transport Users know, understand, accept and trust MaaS solutions and services, not pushing for unrealistic options without other choices, and can make well-informed choices.

Trust for the MaaS PARTNERS: Public Transport Authorities, Public Transport Operators, MaaS aggregators and Operators of alternatives modes of transport outside Public Transport: choosing for cooperation in MaaS is enabled when all cooperating partners in mobility know, understand, accept and trust roles, responsibilities, rules and processes in MaaS.

Trust is based on some fundamental requirements on the Quality of Service for the customer. Some essential ones include cleanness of the vehicles, comfort, on-time performance for picking up and dropping off, safety, and security.

However, trust must be earned, i.e providers and operators of MaaS solutions must make sure that conditions are met for the involved parties to trust the system. Particularly:

- Users must be able to trust and rely on the provided MaaS solutions; they need to be sure that they're provided with user-friendly technologies, with reliable data, they're presented all relevant options, and given fair prices.

- Likewise, the various stakeholders participating in providing a MaaS solution must be able to trust that the overall solution preserves their IP-rights and support their business interests

TRUST IN SMART TICKETING IN MAAS

Smart ticketing offers convenient services for the Transport Users who can have all mobility options to choose from at their finger tips, especially when the mobile phone can be used as a tool to select from mobility options and to process mobility choices based on well-informed decisions. The great potential of smart ticketing is only really able to flourish if it can be based on trust.

Some **key conditions for the traveler** to trust Ticketing in MaaS are the following:

- High quality real-time information

- Transport Users must be sure that the information they receive is complete, i.e. showing all possible options, and not just some; that information is correct and up-to-date, i.e., including any real-time changes in pricing and service offering; that it is relevant, e.g., showing services that are in the proximity and accessible; and that the information is helpful, that is directly usable to achieve one's goal.

- Easy, user-friendly and convenient information services: This includes offering a sin¬gle sign-on access with integrated information before, during and after the trip and helping the traveller in the decision-making process by reducing the necessity for the traveler to have knowledge of tariffs and local situations

- Inclusivity of all Transport Users: All Transport Users must be able to know, understand and accept smart ticketing in MaaS, including digital non-natives, and

Transport Users without smart devices must also be taken care of while using alternative ways to informing them

- Non-discriminatory offering of all mobility options in a transparant way

- Having the certainty of accessing without ifs and buts to various transport services, whenever possible through a single digital channel

- Flexibility

- The service must be able to adapt to changing traveller's needs and it should be personalised in order to take into account personal preferences to make use of smart ticketing comfortable.

- customer care service with human-to-human communication

- The service must offer the possibility to pay with the preferred payment method

- Based on the established governance, run regular audits of all stakeholders and technical systems by an accredated third party (i.e. independant from the MaaS operations)

If the key conditions for trust of Transport Users in MaaS ticketing can be fulfilled and if first experiences of Transport Users when trying MaaS, trust of the Transport Users in seamless mobility from door-to-door and in a seamless digital travel experience will grow. The now often preferred mobility mode, the car, until now seen as the obvious one and only way to travel by many Transport Users[16], can then be seen more and more as just one of the travel options, especially if travel information includes the car as one of the alternatives that can be chosen while showing and comparing travel times and travel costs.

16 The widespread car ownership in the Netherlands, KiM | Netherlands Institute for Transport Policy Analysis (Toon Zijlstra, Stefan Bakker and Jan-Jelle Witte)

Some key conditions for the mobility partners to trust Ticketing in MaaS are the following:

- General condition: the needs of the mobility partner shall be fulfilled

  As MaaS relies on the strength of the mobility partners, it is essential to understand and respond to each other's needs. This includes a sound business case

- Inclusivity of all mobility partners, ranging from large to small companies

  This includes non-discriminatory offering of all mobility options in a transparant way

- Cooperation between mobility partners is, as far as possible, based on mutual agreements

  As many parties are involved, Roles and Rules must be clear for all, including both processes as usual and processes in case of disruption. Clarity with regard to mitigating risks and ownership of residual risks is an explicit component in cooperation

- Cooperation between mobility partners is stimulated and protected by way of regulation

  Regulation point-of departure: transparency of rights and obligations. These should be fair for all mobility partners in MaaS. In addition, regulation is focussed on a framework of rules with optimum commercial freedom of parties and fair competition in mind. This includes regulation with regard to why, what and how questions related to sharing data between parties, including sensitive subjects like sharing commercial data and fair compensation of costs to make data available for other parties. Thus, regulation can function as a MaaS market enabler.

Security and certainty of the payments made by MaaS instrument

If the key conditions for trust of mobility partners in MaaS ticketing can be fulfilled and if first MaaS implementations, like the MaaS use cases in the attachment to this report, are positive, trust of the mobility partners in seamless mobility from door to door will grow, especially when numbers of MaaS Transport Users will climb higher. Right now, traveler behaviour is changing and it shows: many employees of organisations are working some days per week at home and this leads to other travel patterns and other travel mode choices already. Transport Users show more „fluid" needs. This is where ticketing in Maas can be an eye opener for new ways of travel that mobility partners can facilitate.

TRUST IS ESSENTIAL AS IT REACHES THE VERY CAPILLARIES OF TICKETING IN MAAS

Transport Users would choose MaaS options because they trust both the digital and physical MaaS experience. Mobility parties choose MaaS solutions because they find fair and acceptable ways to cooperate with partners in mobility they trust. Regulation comprises enforcement to enable the market and to ensure fair competition in mobility. On this basis, trust can be built.

Disruptions and other unwanted events may happen. In such situations, the immediate question is: **how to keep trust?** Keeping trust in such situations is prepared in clear risk management rules and procedures, including quick, effective communication between mobility partners and with the Transport Users. If these processes are being controlled well, trust can be rebuilt quickly in case of issues. And the information related to actual travel data and ticketing can strongly contribute to this.

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KEY RECOMMENDATIONS

Ticketing is fundamental for MaaS and it should be integrated and interoperable to support a wide offering of mobility choices for passengers.

Ticketing for MaaS requires digitization of transport infrastructure to bridge gaps for different technical implementation and different transport user processes. However, **MaaS would not be possible without collaboration among ALL actors;** collaboration is necessary for an effective MaaS, where an effective governance with rules of the game and roles of public and private players are established. MaaS is only sustainable when it is **created to follow sustainable goals,** when the right governance is in place and when Transport Users sign up, making the user experience central in ticketing and MaaS.

MaaS should be **aligned with the different interests and business models** of each mobility partner, including the acceptance of data sharing agreements based on actors' needs.

CHALLENGE 1: EXISTING DIGITISATION GAPS IN TICKETING AT LOCAL, REGIONAL AND NATIONAL LEVEL

WHO are the actors to address the challenge?
National, regional and local public transport authorities, who need to consider to invest when they prepare to migrate to an interoperable ticketing solution, PTOs and other mobility operators.

Recommendations
❯ Establish cooperation between mobility actors as an organisational basis

1. To establish interoperability, organisational interoperability based on stakeholder needs (see recommendation 2) comes first and technical interoperability follows.

2. Governing bodies can set up a broad regulation framework that enables fair competition and promotes cooperation between mobility parties, including clear conditions for reselling mobility services and ownership of data.

3. As acceptance of all parties involved is crucial for sustainable implementation, setting up the governance framework needs to be realised in cooper-

ation with the public and the private sector, including new mobility market entrants. Result of this cooperation is having a common, coherent set of MaaS goals and related basic rules for cooperation. This can be realised while pursuing a universal vision of mobility, not to be limited by the infrastructure and the fleet today, but towards a future where connected vehicles and services will serve people for all varieties of mobility needs.

4. Within the limits set by the broad governance framework, mobility partners agree with mutual consent on ways to cooperate, with a focus on clear cooperative rules, roles and responsibilities. This basis for organisational cooperation built on mutual consent and trust of mobility partners is an absolute prerequisite to be realised before technical gaps can be bridged.

❯ Arrange technical interoperability after organisational interoperability has been set

1. Having agreed on organisational rules, roles and responsibilities, transparent functional and technical requirements can be set in good cooperation amongst mobility partners in order to arrive at a common basis for technical interoperability.

2. The transparent requirements need to be drafted in an environment of fragmented solutions and, therefore, pragmatic solutions for solving digitalization gaps, realizing interoperability and addressing scalability challenges must be investigated, tried, tested and implemented.

3. According to a number of projects and implementations worldwide, account-based ticketing seems to be a promising solution that can bridge gaps between different technical implementations as well as different traveling concepts. It can serve as an organisational cooperation based technical solution that integrates multiple transport services into a single mobility service within and beyond schemes and borders. Through the different accounts, all linked to the unique user identity as a common denominator for very different mobility services, Transport Users can access mobility services in the whole MaaS mobility chain.

4. Wherever possible, (open) standards should be used in order to be future-proof, expandable and as independent as possible from monopolists.

5. Certification of crucial ticketing components, like contactless readers and ticketing media, contributes to standard quality of these components and the good working thereof as well as confidence of mobility parties and transport users.

6. Certification is important: it is essential that Transport Users and mobility partners can be confident in the quality of the proper working of system components. It is important to realise supplier independency by cross-testing and certification on standards. Certification is the appropriate means to give trust for all mobility parties involved.

CHALLENGE 2: LACK OF UNDERSTANDING OF STAKEHOLDERS' NEEDS AND ROLES

Who are the actors to address the challenge?

PTA, PTO, Shared mobility provider, MaaS operator, MaaS integrator, transport users.

Recommendations

> **Arrange MaaS according to governance needs**

1. A major cause of the reality of fragmented, unique, proprietary and often hard to connect solutions is the focus on local or regional optimisation. MaaS requires a wider view, a view that still leaves room for local optimisation but also focuses on connecting to cooperation beyond organisational, local, regional and also country borders.

2. A centralised approach offers the possibility of exercising the governance of multimodal mobility. The role of the MaaS Integrator can probably be played by the Public Administration. This way, the MaaS platform can be used as an effective governance tool to achieve sustainability objectives in transport in addition to achieving the goal of seamless mobility.

3. Related to governance partners like PTAs, a key need to be addressed is: flexible adaptation to Transport Authority policies. This can be realised by way of central processing in back-offices.

4. Bring all the actors together to co-define the MaaS systems, as concrete action to build trust. This must be clear: what are their roles and responsibilities per role in the chain. And discuss if rules are in place and what rules are needed. This could be done organizing a committee chaired by local officials to allocate resources for ticketing along with mobility services with goals to be inclusive, sustainable, and seamless.

> **Align MaaS and the business model of each mobility partner**

1. Organisational interoperability is the major challenge as mobility partners have their own goals, governance models or business models. These need to be aligned before cooperation can be realised.

2. Recognise the difference between mass Public Transport ticketing and shared mobility access processes and the need to provide flexible fares to transport users, separating payment from access to mobility offers with a goal to combine offers among participating Mobility Service Providers.

3. An enabling regulation point-of departure is crucial for all mobility partners: transparency of rights and obligations. These should be fair for all mobility partners in MaaS. In addition, regulation needs to be focussed on a framework of rules with optimum commercial freedom of parties and fair competition in mind. This includes regulation with regard to why, what and how questions related to sharing data between parties, including sensitive subjects like sharing commercial data and fair compensation of costs to make data available for other parties. Thus, regulation can function as a MaaS market enabler and an excellent basis for negotiation of mobility partners in preparing cooperation.

4. Each platform or several platforms together need governance that gives each participating partner confidence, trust and security in order to bring their own business model to success in interaction with the MaaS platform and the other partners.

5. Aligning the different approaches can be done by way of agreements, by fulfilling needs of each partner and by creating a basis of trust.

6. Mobility partners need to have trusted open and integrated platforms, offering inclusivity of all mobility partners involved with regard to the planning, retailing, distribution and ticketing covering all mobility services.

7. Related to mobility partners, some key needs to addressed are: convenient, flexible adaptation to changes, e.g. in tariffs, from a central mobility operator level including "service packs", dynamic fares in case of events, pay per use, price capping etc., as well as addressing the worry that customer intimacy will be less or lost.

8. Invest in digital infrastructure for ticketing, while reusing existing systems as much as possible: optimum cost in investments is a standard business

requirement. ABT can bridge technical gaps and allows for reusing existing systems.

❯ **Make MaaS a success while attracting transport users to choose MaaS services**

1. In order to realise governance and business goals, fulfilling the needs of transport users needs to be a central goal both from a governance and a business perspective: if the needs of transport users can be fulfilled, they can be attracted to use MaaS solutions in traveling, thus contributing to the governance goal of sustainability.

2. Related to travel users, some key needs to be addressed are: convenience and flexibility, the ability to use a user-friendly medium that they possess like a mobile phone and ticket products with a well to understand tariff based on non-discriminatory offerings, inclusivity and at a guaranteed fair price that fit to user needs and that can deliver an optimum user experience. In addition, protection of sensitive privacy-related data must be guaranteed at all times.

CHALLENGE 3: EXCHANGE OF DATA: REGULATIONS, TRUST, PRIVACY ISSUES, COMPETITION ISSUES

Who are the actors to address the challenge?

PTA, PTO, MSP, MaaS operator, MaaS, integrator, the transport users.

Recommendations

❯ **Create an ecosystem for data sharing accepted by all parties involved**

1. The governance framework needs to be built in collaboration with and through the participation of the public and private sectors, including market newcomers. Such a regulatory framework should establish preconditions for developing an open ecosystem of data sharing, integrated services, and fair competition, trusted by all involved.

2. It is essential to provide technical and financial support to operators to ensure interoperability and access to data.

3. Promote co-creation for data-sharing frameworks, through pilots and trainings for operators (capacity building).

4. Prepare the data, prepare any API documentation of existing ITS systems, including the ticketing system or more generally the "access" system of each single mode of transport. In fact, the "access" is the most difficult phase with respect to the "information" which, thanks to standards, is already extensively scalable.

❯ **Make agreements based on needs in sharing data**

1. Parties involved in MaaS need to have an actual insight in their information flows in order to be able to share information in (near) realtime according to agreements with their partners and need to be able to flexibly adapt tariffs and other parameters while making optimum use of back-office systems that, in an interoperable network, can be enabled to communicate with other back-office systems with mobility partners.

2. Opening ticketing systems will go with a cost. Fair distribution of compensation for investments to be made clearly contributes to trust of the cooperative partners.

3. APIs offer access to data, partly sensitive data. Therefore, to keep trust in sharing data, access to APIs and data thereof must be managed according to agreements and regulation: only identified partners, including resellers (working according to controlled agreements) with a need to know can use identified functions and data combined with sufficient security controls.

4. Use modular and open solutions for ticketing:
    a. API shall be clearly defined and documented
    b. API shall be delivered at the same time as the ticketing system
    c. API shall rely on open standards
    d. API shall be tested to prove functionality and performance even if not to be used for the moment
    e. Customer management shall be shared at regional level, i.e. one single customer account shared between MSPs

5. Providing consistent high-quality data (KPIs or process to check this) with interoperable standards is very critical. All stakeholders should define what users and travel user data are needed to run the MaaS platform, meeting the privacy rules. However, this may require travel users' consent. Data security and privacy is a joint responsibility of the operator and/or authority as well as the MaaS provider – and should be made clear right from the start of preparing cooperation
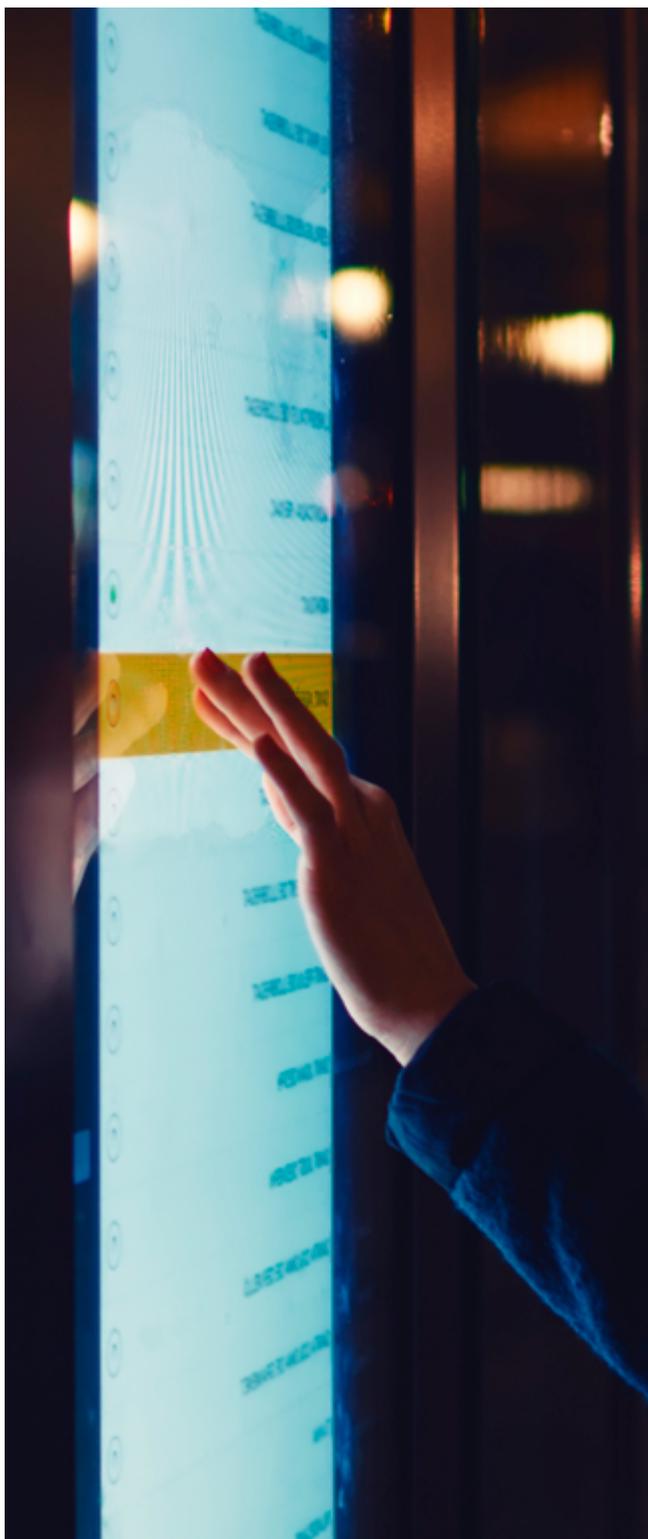
6. There should exist a contract between the Operator and/or authority and the MaaS provider tying up both in what concerns data sharing, data security and data privacy. This contract must respect all relevant regulations including privacy rules in the EU territory and other specific regulations elsewhere to protect the user privacy.

7. There are lots of available data. However, not so many data are needed to be shared. So if parties can concentrate data, excluding data with industrial or commercial value, in a single repository this could act as a data hub to share needed information. Any cooperative solution shoud be discussed and agredd.

8. The data needed will depend on the mobility services available on the territory and mainly on the authority politics in terms of mobility.

❯ Make use of standard procedures and standard protocols while sharing data

1. APIs, Application Programming Interfaces for mobility, can serve as standard access points for all mobility partners, having the same data formats and thus avoiding the need for ticketing system owners to multiply developments in order to connect with other parties. APIs allow the monitoring of access to and securing of the whole system.

2. APIs are independent from a specific transport means. The APIs are not dependent on specific technologies used for the different connected mobility systems. APIs are technical solutions to facilitate communication between different mobility systems.

3. Common protocols for data sharing have to be defined in order to facilitate the integration of the different subjects/operators. Moreover the datasets provided have to be clearly defined and accepted by all the different subjects/operators (i.e. provisioning of static data, of dynamic data, of alerting data, etc.).

4. Encourage the use of existing standards for data-exchange.

ANNEX I: TICKETING IN MAAS CASE STUDIES

ANNEX II – GLOSSARY

ABT	Account Based Ticketing
API	Application Programming Interface
DRT	Demand Responsive Transport
EMV	Europay MasterCard Visa
IPR	Intellectual Property Rights
KPI	Key Performance Indicator
LTA	Limited Traffic Area
MaaS	Mobility as a Service
MOD	Mobility on Demand
MSP	Mobility Service Provider
PTA	Public Transport Authority
PTO	Public Transport Operator

ANNEX III - IMPORTANT READS (LINKS, SELECTION OF STANDARDS)

Many standards and relevant documents have been written in the area of Ticketing and MaaS. A very restricted number of standards and documents were selected and listed in this annex as they served as points-of-departure and sources for a number of other documentation and ticketing in MaaS projects in the field.

LINKS TO DOCUMENTS AND ARTICLES

- EU report Remaining challenges for EU-wide integrated ticketing and payment systems (2019)

- UITP, Polis & EMTA Joint opinion on EU-wide integrated ticketing

- UITP Policy Brief and Report – "Ready for MaaS? Easier mobility for citizens and better data for cities" (2019)

- UITP report – "Demystifying ticketing and payment in public transport" (2020)

- MaaS Alliance: MaaS Market Playbook (2020)

- Data4PT website, offering links to the European standards Transmodel, NeTEx, SIRI and OpRa

- TTS Italia MaaS Guidelines

- Calypso Networks Association – "Best Practices For Durable Systems" (2019)

LINKS TO EU LEGISLATION

Adopted & in force
- The General Data Protection Regulation – GDPR
- The e-Privacy Directive
- The intelligent Transport Systems (ITS) Directive
- The Multimodal Travel Information Services Regulation
- The Open Data Directive:

UPCOMING
- The Digital Services Act
- The Data Act
- The Data Governance Act
- The Multimodal Digital Mobility Services initiative

WORLDWIDE (ISO) AND EUROPEAN (CEN) STANDARDS

ISO/IEC TR 4447, PD ISO/TR 4447 Intelligent transport systems – Mobility integration – Comparison of two mainstream integrated mobility concepts (publication is being prepared)

ISO/IEC 24014-1, Public transport. Interoperable fare management system – Architecture (2021)

ISO/IEC 24192, Cards and security devices for personal identification. Communication between contactless readers and fare media used in public transport, 2 parts (2021)

ISO/IEC/TR 20526, Account-based ticketing standards requirements (2017)

CEN/EN 12896, Public Transport - Reference Data Model (short name: Transmodel), 10 parts including part 10 on alternative modes (latest versions)

CEN/TS 15531, Public transport. Service interface for real-time information relating to public transport operations (short name: SIRI), 5 parts (latest versions)

CEN/TS 16614, Network and Timetable Exchange (NeTEx) – Public transport network topology exchange format, 5 parts including part 5 on alternative modes (latest versions)

CEN/EN 16794, Public transport – Communication between contactless readers and fare media, 2 parts (2017). This is the actual Smart Ticketing Alliance standard for certification of ticketing devices and ticketing media

CEN/TR 17370, Public transport. Operating raw data and statistics exchange (short name: OpRa) (2019)

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