TICKETING FOR MAAS

BEST PRACTICES FOR DURABLE SYSTEMS

EDITORIAL

Beyond its original function of collecting revenues from transport, ticketing is now considered as the armed wing of Mobility as a Service, known by the acronym of MaaS. Ticketing must enable mobility services to be combined and offer passengers a seamless, end-to-end, easily accessible transport offer.

Yet this new ambition of ticketing will only be achieved if systems are well-designed and highly scalable. This is indeed a major challenge: with streams of new requirements flowing in, linked in particular to MaaS, the need for ticketing systems to be flexible has never been so great. Yet ticketing systems, which are sometimes subject to vendor-locking do not always provide the appropriate solutions to this challenge.

The purpose of this document is to highlight best practices to help ticketing systems reach their target qualities and performance, and to be a tool in the hands of transport authorities and operators to implement their mobility policies.

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INTRODUCTION

Operators and transport authorities face a twofold challenge: improve customer service while maximising revenues. Travellers who were once considered as mere users are now treated as customers who require efficient service and seamless access to transport networks. At the same time, the quest for financial viability forces operators to optimise revenues and fighting fraud has become a major concern.

Ticketing is certainly one of the key factors to address these two concerns for transport networks. 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. But transport networks still need to manage their system efficiently to take advantage of the full potential of ticketing.

What are the best practices for installing or adapting a ticketing system to achieve sustainable mobility?

Designing or renewing a ticketing system nowadays means choosing between a wide range of technologies, architectures, customer media: NFC or QR code, card-centric or server-centric, prepaid or post-paid are important issues. But experience shows that the real effectiveness of ticketing depends above all on flexibility and the ability to meet new needs over the entire lifetime of the system. Without scalability and flexibility to evolve, ticketing cannot be an effective enforcement tool for mobility policies.

The requirements that arise throughout the life cycle of ticketing systems are numerous: new fare media and new services for customers, implementing interoperability schemes, fare updates, integrating new mobility providers, etc. But their implementation often proves difficult, with high costs that can put clients off.

The initial design of the system is paramount: a black box design of the system makes clients dependent on manufacturers. While prices have been kept reasonable thanks to the competitive tendering process when the system was acquired, further upgrades can only be managed on an over-the-counter basis, and prices are subject to inevitable increases.

The key challenge is to keep control of one's system.
The right level of mastery required is the one where for any significant upgrade, suppliers can compete against one another.

The golden rules to be followed in this regard are mostly common sense. Clients are responsible for their implementation. They must take into account the total cost of ownership of the system, not only the initial purchase cost.

This note lists the best practices that are generic and universally applicable, and can be adapted and adjusted as required.

DEFINITIONS AND ACRONYMS

• ABT OR SYSTEM-CENTRIC

An ABT (Account Based Ticketing) system is a ticketing system where the data on travel rights and tickets are stored in a central server linked to a customer account, the portable object only serving as a means of identifying the customer and linking him/her to his/her account. The software processing of the fare media is then carried out by the central server.

• API FOR TERMINALS

An API (Application Programming Interface) for terminals defines a common interface for software application management. At the ticketing terminal level, several API can exist, from contactless coupler management to higher level ticketing applications.

• CENTRIC – CARD SYSTEM

In a «centric card» ticketing system, tickets are stored in the customer media. Even if tickets are replicated on a central server, the content of the customer media is decisive. Real-time software processing of tickets is generally carried out by front-office terminals.

• CEN

CEN (European Committee for Standardisation) is an association of national standards bodies from 34 European countries. CEN is a standardisation body recognised by the European Union as being responsible for the development and definition of standards at a European level in collaboration with ISO.

• CHIP

Chips are electronic components, designed and manufactured by specialized silicon manufacturers. Chips are integrated in customer media, such as cards, and are the smart elements that store and process data.

• CONTACTLESS PORTABLE OBJECT

This term refers to contactless smart cards, contactless java cards, NFC mobile phones, USB sticks with a contactless interface, and any other contactless customer media.

• DATA MODEL

Data models describe how information is encoded and stored in customer media and business rules. A data model is a common language that enables interoperability between mobility stakeholders sharing the same customer media.

• EMV

Europay Mastercard Visa, abbreviated to EMV, has been the international industry standard for payment card security (smart cards) since 1995.

compliance with international standards, of these sectors are variable. Mifare, Calypso, Felica, Desfire, Cipurse are the best-known technology sectors.

• INTEROPERABILITY

Interoperability is the ability of a system or of a product to work with other systems or products without requiring additional interactions from travellers.

• ISO

ISO (International Standardization Organization) is an independent, non-governmental international organization whose 164 members are the national standards bodies. It brings together experts from all countries to develop international standards.

• MAAS – MOBILITY AS A SERVICE

Mobility as a Service allows people to move from A to B, regardless of the mode of transport used, whether public or private. It is based on full intermodality of all mobility services and a merger of ticketing and multimodal information tools.

• OPEN PAYMENT

Open Payment systems are ABT systems where travellers use their contactless bank cards on transport validation terminals to pay for and validate their «travel rights».

• OPEN SOURCE SOFTWARE

Open Source software is software the source code of which is freely accessible for free, usable and modifiable, distributed under a license approved by the Open Source Initiative and which guarantees compliance with the rules of this organisation.

• SECURITY MODULE (SAM)

Security modules authenticate Customer media (e.g. smartcards), terminals and data exchanged between them. SAMs are implemented in smart cards but as services are increasingly cloud-based, they can also be hardware components integrated into a server (Hardware Security Module aka HSM).

• TECHNOLOGY SECTOR

Contactless ticketing systems are based on secure technologies for exchanging data between customer media and operators' terminals. This is referred to as a technology sector. The performance levels, in terms of reliability, safety, transaction speed, compliance with international standards, of these sectors are variable. Mifare, Calypso, Felica, Desfire, Cipurse are the best-known technology sectors.

1. MAJOR BENEFITS OF CONTACTLESS TICKETING

The definition of ticketing, and the description of its functions, has been the subject of many studies. This paragraph lists many of the benefits it brings to customers, operators, and transport authorities. It also highlights the added value of ticketing in terms of quality of service, ease of access to transport, interoperability and contribution to MaaS.

› 1.1 – IMPROVING CUSTOMER EXPERIENCE

First of all, contactless ticketing allows patrons of transport networks to validate their tickets in a fluid and simple way, with a durable media using a fast and natural hand motion.

Contactless portable media can store several tickets according to the needs of the bearer and reload them automatically at any time online or using vending machines.

Thanks to the ability to store profiles in cards and phones, travellers who are entitled to special fares do not need to show evidence during inspections.

When customer media are registered, bearers can have their tickets/travel rights restored in case of loss.

Customer media may also give their bearers access to other mobility services based on interoperability agreements.

These customer media, which are often contactless cards, have very long lifetime and wearvery slowly.

› 1.2 – FACILITATING NETWORK OPERATIONS AND IMPLEMENTATING FARE POLICIES

Implementing contactless ticketing systems can accelerate access to transport networks through very fast transactions, just over 0.15 seconds, and cope with large passenger flows. For example, at La Défense, the Paris business centre, contactless technology enables 60 passengers to go through each gate every minute.

Contactless ticketing also enables implementing more elaborate fares thanks to the technical performance of the media used (storage of profiles and tickets, connection management, etc.).

Transport networks may collect statistical data on passenger flows at specific points in the network to fine-tune its transport plan to make it as responsive as possible to user demand for mobility.

Finally, contactless technology reduces maintenance costs associated with removing mechanical modules from validation terminals.

› 1.3 – IMPROVING THE FIGHT AGAINST FRAUD

Contactless ticketing enables compulsory validation at gates (metro, trains…) and on-board validators (buses, trams, etc.) and thus facilitates the detection of fare evaders.

When it relies on state-of-the-art standard security mechanisms, the risk of technological fraud and the use of stolen media are significantly reduced.

The main threats of technological fraud that ticketing systems face are:

- → counterfeiting, which consists in forging transport tickets to use or sell as if genuine,
- → cloning, which consists in duplicating transport tickets and to use them several times,
- → content alteration, which consists in modifying the content of a medium in order to change the nature and/or quantity of the tickets/travel rights/value it contains.

To fight these threats, contactless ticketing systems implement various security measures:

- → the intrinsic physical security of the customer media, which prevents unauthorized reading and modification of the data stored on it,
- → the protection of secret elements that secure transactions, usually cryptographic keys, within hardware security modules,
- → the implementation of fraud detection through the identification of inconsistencies that detects the use of the same customer media at two places that are too far from one another to be reached within the time between the two validations,
- → the establishment of deny lists in terminals to deny access to media reported stolen or classified as fake.

If implemented correctly and updated regularly in a state of the art manner, these security measures can significantly reduce technological fraud.

› 1.4 – FACILITATING INTEROPERABILITY

Contactless ticketing systems can undoubtedly improve interoperability between mobility operators within a given commuting area and across such areas. Indeed, contactless media can provide:

- → Basic media interoperability: users can load and use fare products from different networks on the same media. This model does not imply any commercial or tariff agreement between the various transport operators.
- → Interoperability of transport tickets: users can travel on different transport networks using the same transport ticket, which implies a commercial and fare agreement between transport operators.

› 1.5 – CONTRIBUTING TO MAAS

Whilst ticketing was initially a mere fare collection tool, it is now considered as an essential enabler of MaaS.

The emergence of the MaaS concept has enabled the integration of many new mobility services such as car sharing, bicycle-sharing, car parks, taxis, ride hail services and car-pooling with traditional public transport. To get from A to B, travellers have several mobility options, connected to one another, with an open choice of alternatives according to preferences, with multimodal information available at any place and at any time, with easy and unconstrained access and connection from one service to another.

Provided it is both accessible and open, contactless ticketing can accelerate the implementation of MaaS, as it offers concrete solutions to facilitate access to all forms of mobility by integrating sustainable development concerns and by influencing modal balance.

MaaS has given back to ticketing a major role as the gateway to mobility for all, after having often been wrongly perceived as just a means of paying for transport.

2. ECONOMIC AND INDUSTRIAL CHALLENGES FOR TRANSPORT OPERATORS

Ticketing systems represent an important investment for operators and transport authorities. Such investments should only be made if their sustainability is guaranteed for at least 15 years, which implies that the system can evolve at a reasonable cost; for example, adapting to the new needs of travellers, monitoring the emergence of new technologies, regularly updating security measures or applying any pricing policy in a reactive manner. The total cost of ownership of the system is the performance indicator of these system capabilities and is the preferred measure of the financial efficiency of the ticketing investment.

› 2.1 – ENSURING THE SCALABILITY OF THE SYSTEM

To ensure the ability of a ticketing system to evolve, care must be taken when choosing the solution, suppliers and implementation methods.

Enabling competitive bidding over time.

Suppliers, integrators, terminal manufacturers and card providers may be tempted to promote their own proprietary solutions, making it more difficult to introduce competition between suppliers over the life cycle of a system. It also happens that some providers no longer ensure the continuity of service of their proprietary system, which puts networks that have adopted it into great difficulty.

It is therefore necessary to ensure that the technology of a ticketing system is not left in the hands of a single supplier, so as to benefit from compatible solutions provided by other manufacturers in the event of failure from the initial supplier of the system.

Ensure the system's ability to evolve.

A ticketing system is likely to evolve over its lifetime to adapt easily to network extensions, the integration of new operators, fare changes, the emergence of new technologies, etc. It is therefore necessary to design from the outset a system that is scalable and configurable. The emergence of new developments, such as NFC mobile ticketing, Account Based, Open Payment etc. often involve new players.

The addition of these solutions by these new players can prove complex, costly and time-consuming, especially if the original system is not based on open standards. If a transport operator wants to guarantee the durability and scalability of its system, it must therefore have control over it and rely on open solutions that are not specific to a single manufacturer.

› 2.2- ENSURING A HIGH LEVEL OF SECURITY

During initial implementation, ticketing systems most often implement state-of-the-art security mechanisms and are therefore well protected against technological fraud.

However, the level of threat is constantly increasing as piracy techniques evolve. In all areas of information technology, regular upgrades are necessary to maintain a high level of security.

A ticketing system must regularly upgrade its security mechanisms to adapt to new threats.

› 2.3- IMPLEMENTING FARE POLICIES

Transport operators and authorities must keep control over fare policies. Indeed, fare policy is a powerful leverage for organising mobility within a given area and, as such, it is a strategic asset for local transport policy.

Ticketing systems must enable adapting fare policies in a flexible and simple way.

› 2.4- CONTROLLING TOTAL COST OF OWNERSHIP

The Total Cost of Ownership (TCO) represents the total cost of an asset, such as an IT system, over its entire life cycle. It takes into account not only the direct costs of materials, equipment, network infrastructure, software, specific developments, licenses, etc., but also all indirect costs, or hidden costs, such as upgrades, maintenance, administration, user and administrator training, technical support and recurring costs (consumables, electricity, rent, etc.).

During its lifetime, a ticketing system needs to evolve: new technologies, security updates, new fare policy, and also potentially new suppliers in the case of the initial supplier failing.

Evolution costs contribute significantly to the ticketing system TCO and can sometimes prevent upgrade projects from going ahead.

To minimize TCO, operators and transport authorities must keep control of their systems.

3. THE CONDITIONS FOR CONTROLLING ONE'S TICKETING SYSTEM

For operators and transport authorities, controlling their ticketing system can appear to be overwhelming and costly. They often prefer to contract out this responsibility to an integrator because they consider this control too technical to handle themselves. But if they cannot carry out the task internally, they can delegate the tasks described below to neutral third party acting on their behalf, to ensure their effective implementation.

› 3.1 – MASTERING AND OWNING YOUR DATA MODEL

The ticketing data model of a transport network represents the IT «translation» of its fare policy, in particular so that it can be implemented through its terminals and customer media.

The purchaser of a ticketing system must have all the rights to use it freely, adapt it and pass it on to third parties. It must have an understanding and control of its data model.

This control requires a real investment, which remains very limited compared to the risks incurred by the networks in the medium and long term: not being able to carry out major changes such as interoperability with other networks, the implementation of a new fare policy, can result in very high costs.

Indeed, if the purchaser has not integrated the data model and its governance in the specifications, the system supplier may develop a proprietary data model without communicating it to the transport operator. And even if it does, it will have an undeniable competitive advantage over its potential competitors in future calls for tenders. Worse still, experience shows that there may be discrepancies between the version of the data model actually implemented in the equipment and the version communicated by the supplier.

If the issue of controlling the data model of the transport network is not factored-in from the design stage, then, at least, it is necessary to require that the supplier gives away this model and to provide for significant penalties should the actual implementation of the system deviate from the model.

It is recommended to use open data models whenever they exist, adapted to the specific needs of networks and independent of terminal, card or ticketing system providers.

CONTROLLING YOUR SYSTEM THE RESPONSIBILITY OF THE PURCHASER

Controlling your ticketing system is the responsibility of the purchaser whether it is a transport authority, a transport operator or any entity responsible for the system. It must be concerned about the total cost of owning the system, not just the initial purchase cost.

Minimizing only the initial investment, neglecting the TCO, is generally synonymous with a «black box» implementation, without any control. In contrast, integrating the cost of ownership as a criterion in tenders opens up the choice of a modular, scalable and controlled solution, on the basis of a financial assessment that factors in all operating and maintenance costs and the estimation of evolution costs.

› 3.2– OWNING AND MANAGING CRYPTOGRAPHIC KEYS

Ticketing system managers, transport authorities and transport operators must possess the keys used to secure writing and reading of data on the smartcards or any other media used on their networks.

Ticket system suppliers must therefore provide the technical description of the keys and their implementation on the security modules (SAM) deployed on the various ticketing equipment.

The system manager must also be able to use them freely, within the limits of local security rules.

With regards to the security architecture of the system, it is recommended to use a standard solution that can be implemented by different providers, in particular as regards the key generation process, which should be implemented by an experienced third party, independent of card, terminal or system providers.

In any case, it is necessary to request the specification of the security system, including the key ceremony process, to be able to generate new keys if necessary.

› 3.3– RELYING ON A MODULAR ARCHITECTURE & API

Transport networks must require their suppliers to base their solutions on a modular architecture that ensures scalability. This will enable modifying one module independently of all others without having to completely redesign the ticketing system.

The implementation of this type of modular architecture requires open and published interfaces between each module and with other systems.

The objective is to have a system that integrates an interoperable approach easily and cost-effectively. This enables:

- → easily interfacing at various interoperability levels with other ticketing systems: from sharing customer media to implementing fare products supported by several operators,
- → easily interfacing with a clearing house for a fair distribution of revenues between interoperability scheme stakeholders.

Regardless of the number of suppliers, each must provide the transport network with the API they use to control peripheral equipment so that the network can adapt them or provide them to third parties. This facilitates competitive tendering of suppliers when supplier contracts are renewed, thus allowing:

- → to decorrelate the life cycle of the equipment and the applications embedded on it,
- → to open up applications embedded in equipment to third-party suppliers.

In addition, it is important to require that systems be open, shareable and understandable by professionals other than ticketing experts, e.g. to allow interfacing with other systems sharing data such as ticketing, AVM/AVL, passenger-counting etc.

As a consequence, it becomes possible:

- → to provide a clear view of the use of the transport network and the relationship between supply and demand,
- → to integrate new security solutions to better fight fraud,
- → to provide users with a homogeneous and personalized mobility experience via a single mobile application integrating, for example, itinerary search, ticket purchase and validation and real-time information.

REFER TO MODULAR ARCHITECTURES AND OPEN INTERFACES

Some countries have issued recommendations on the architecture of ticketing systems.

In France, the AFIMB, the French Agency for Multimodal Information and Ticketing, has produced a reference document entitled «Architecture and Security of Ticketing Systems».

This document is intended to help procurement from operators and authorities to write specifications for tenders.

Compliance with this standard guarantees that the system's software follows best practices with well-specified interfaces. It is thus possible to change suppliers during the lifetime of the system.

› 3.4 – REQUIRING DUAL SOURCES AT ALL LEVELS OF THE SYSTEM

To have control of a system and to guarantee true independence from suppliers, one must ensure that there are several suppliers capable of producing compatible solutions for each component of the system.

Relying on a single source component within a system poses a major risk, not only with respect to controlling the system, but also its sustainability. Failure to supply a component can lead to a malfunction and potentially to the shutdown of the system.

The only way to address this risk is to have a dual source for all components of the ticketing system, and therefore to ensure its availability beforehand.

Smartcards are a critical issue, since a shortage can force an operator to let its transport network open for an indefinite period of time, and therefore lose revenue. Such cases have occurred in the past on existing ticketing systems.

The causes of shortages can be temporary, whether technical, social, industrial or financial, or definitive, for example, the manufacturer's strategic decision to abandon a business considered insufficiently profitable.

It is therefore important to ensure that the card type and even the card technology chosen, can be procured from several suppliers, which is not the case of contactless ticket products that do not embed a microprocessor, as they do not meet any recognised standard and are the property of a single manufacturer.

SMARTCARD CHIP, THE ACHILLES' HEEL OF THE SYSTEM

Procuring compatible components from a selection of suppliers is mandatory. None must be available from one single supplier.

A contactless card chip is a component that is not always perceived as critical, because it is embedded in a card, which is provided by many suppliers in a competitive market. However, it is important that, for a given technology, several independent chip manufacturers can provide the required chips. The stakes are high, because a simple supply disruption at this level can bring a ticketing system to a halt.

The strategies of chip manufacturers are beyond the control of transport operators. The frequent mergers and acquisitions of companies in this field make industrial strategies unpredictable and the technologies being abandoned altogether becomes a significant risk. This happened in the 2000s, when a world leader in electronic components, Motorola, suddenly decided to stop its contactless business line; the networks that had chosen this supplier suffered significant damage.

It is therefore essential to ensure the existence of at least two independent chip suppliers providing the chosen technology.

4. THE VALUE OF OPEN AND STANDARDIZED SOLUTIONS

Mastering a ticketing system depends on the ability to open up its evolutions and upgrades to competition over its entire lifecycle.

Mandating the compliance with standards is the best way to ensure that there is little or no proprietary bias in the system. The ultimate solution to avoid vendor-locking is to mandate the use of Open Source software, which is accessible and usable by all on a level-playing field.

› 4.1 – RELYING ON OPEN STANDARDS

Transport networks must ensure that contactless ticketing solutions are based solely on customer media that rely on open standards, available to all suppliers, and the compliance of which is ensured by certification.

This is all the more necessary when a network wants to be interoperable with others; communication between a contactless portable object and a terminal requires the clarification of several technical rules to ensure the technical interoperability between different suppliers of terminals and customer media.

When these rules are applied, they become a de facto standard, supported by a group of users and can become an official standard if they are accepted by a larger body (national bodies such as AFNOR or DIN, or international bodies such as CEN in Europe and ISO for world standards).

For example, CEN has published a standard, CEN TS 16794, based on ISO 14443, to specify the rules to comply with in terms of contactless communication between customer media and terminals in the transport sector.

This standard covers both terminals and contactless cards, is interoperable with the NFC Forum specifications for NFC phones and compatible with the EMVCo Level 1 standard used for payment transactions. The Smart Ticketing Alliance has defined a certification process associated with this standard, on both the smartcard and terminal sides, implemented by several European certification bodies and laboratories. In banking systems terms, it is equivalent to EMV Level 1 for transport.

Calypso customer media are covered by a certificate of conformity to the reference specifications, open to all suppliers and which completes the level 1 certification. It is equivalent to EMV Level 2 in the banking sector.

Combining these two types of certification ensures interoperability both at the contactless communication level and at the application level of customer media from different suppliers.

It thus enables competition between suppliers, while guaranteeing the interoperability of these products.

CERTIFICATIONS TO MANDATE IN CALLS FOR TENDERS

Only the certification both of exchanges between customer media and terminals, at the radio frequency (RF) level and at the functional specifications level, can guarantee the ability for ticketing systems to interoperate.

- **RF certification: CEN has published the CEN TS 16794 standard and the Smart Ticketing Alliance has defined a certification process associated with this standard, implemented by several European certification bodies and laboratories.**
- **Functional certification: for users of the Calypso standard, the Calypso Networks Association has set up a functional certification process in relation to the reference specifications, which is open to all suppliers.**

› 4.2- USING OPEN SOURCE SOFTWARE

The Open Source model is based on balanced relationships between all potential contributors to a project to encourage the involvement of all parties by preventing a takeover by one of the stakeholders.

Open Source software is defined as being free and freely accessible, usable and modifiable, distributed under a license approved by the Open Source Initiative. These licenses grant intellectual property rights worldwide for as long as the rights last, for all uses and on all types of media.

While the use of open standards and corresponding certifications guarantee interoperability and open competition for contactless customer media, there is still no equivalent for terminals, the implementation of which by ticketing integrators remains proprietary and often carried out as black boxes.

Transport networks are therefore advised to ask ticketing integrators to use Open Source software whenever it exists.

Since Open Source software is accessible to all suppliers under the same conditions, everyone is thus free to make an offer that meets the needs expressed by transport authorities and operators, which ultimately contributes to fair and open competition.

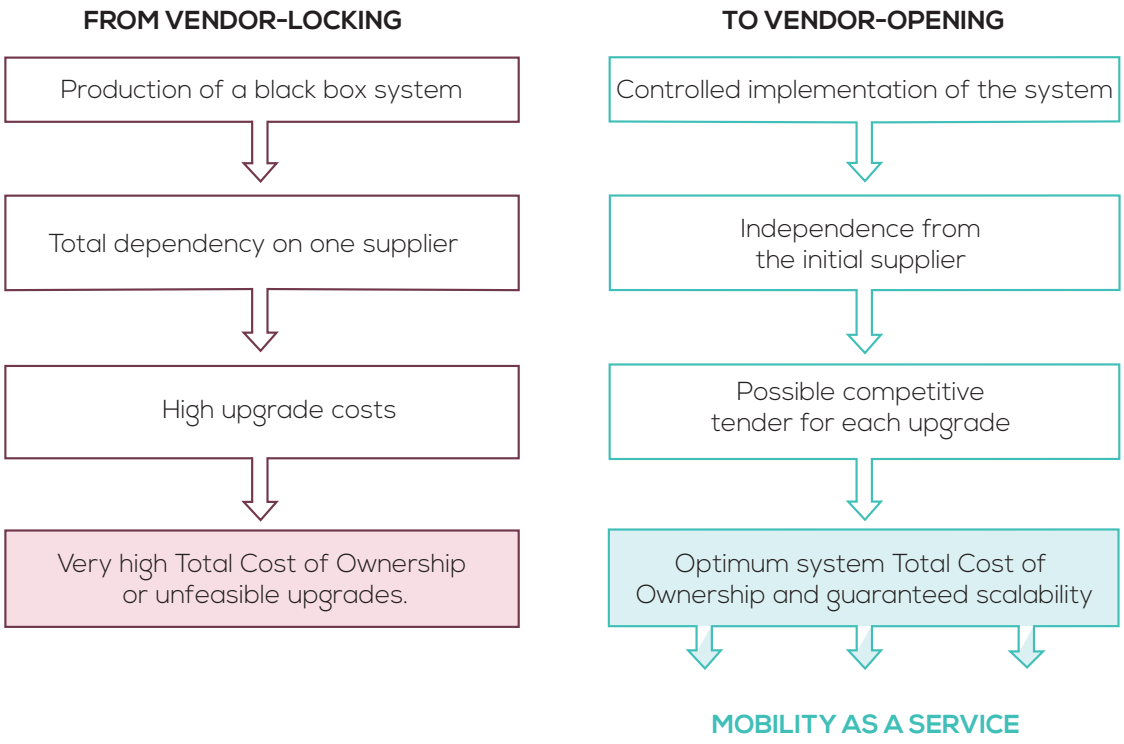
THE FINANCIAL IMPACT OF USING OPEN SOURCE SOFTWARE

When software is the property of a supplier, not only do over-the-counter modifications obviously have a costly impact on upgrades, but because of the «black box» effect, it is also very difficult to assess how much they are really worth. It is therefore difficult to negotiate with suppliers and the notion of the order of magnitude of the price is lost.

With the use of Open Source software, many developers can measure the real impact of the requested evolution and make a precise estimate. This can result in differences that can range from 1 to 10; i.e., for example, a change proposed at 500,000 euros by the supplier in an over-the-counter context, is carried out for an amount of 50,000 euros by a developer on open source software. These are actual figures from actual cases.

PROPRIETARY VS OPEN

CONSEQUENCES ON THE LIFE CYCLE OF A SYSTEM



CONCLUSION

Implementing a ticketing system, which typically lasts for up to 20 years represents an important investment. The system must enable evolutions and upgrades throughout its life. It is therefore important to make the right choices right from the design phase of the project. It is also important and to ensure the ability of the system to evolve, regular competitive bidding between suppliers and control of fare policies, which is an important leverage of public transport policies

The recommendations in this document all converge towards the same objectives and can be applied regardless of the architecture model chosen: card-centric, ABT, Open Payment, etc.

They also ensure the best conditions for implementing interoperability between systems, and in this respect, they are particularly suited to MaaS (Mobility as a Service) to aggregate all forms of mobility, including the latest and lightest. These new mobility services will thus be much easier to integrate into an Open Source-based open system, respecting standards, with open API.

The implementation of MaaS, which is still in its infancy, can only be truly effective if the common sense rules developed in this document for the design of future integrated ticketing systems are followed.

BEST PRACTICES FOR A SUCCESSFUL TICKETING SYSTEM

The purchaser of a ticketing system must always ensures that:

- → **The system is based on established and recognized standards.**
- → **System components are available from several compatible and independent suppliers.**
- → **The system architecture is modular and based on well-defined, published and royalty-free API.**
- → **The cryptographic keys of the system are its property and it can manage them.**
- → **The data model belongs to the purchaser and it has full control over it.**
- → **Open source software is the preferred option when it is available.**

EVALUATE YOUR TICKETING SYSTEM

You are setting up a new ticketing system or you have a system in operation.

Best practices, which are the main topic of this document, are the subject of the questionnaire below.

You can assess the level of control of your ticketing system, and consequently its ability to evolve and meet your objectives.

ASSESSING YOUR LEVEL OF CONTROL OF YOUR SYSTEM

Questions / Answers	Yes	No
Can you carry out upgrades through an open competitive tendering process?		
Have you ever been unable to implement an upgrade?		
Have you taken special precautions to ensure continuity of service should a supplier fail?		
Do you have access to the source code of the software used in your system?		
Can you easily change the fares (fare rules, fare products, etc.)?		
Can you integrate new suppliers in the system as you go along?		
Can you open up the system to new partners, private or public operators?		
Overall, how do you rate your control over your system on a scale of 1 (no control) to 5 (full control)?		
Please comment your answers		

ASSESSING BEST PRACTICES MENTIONED IN THE DOCUMENT

Questions / Answers	Yes	No
Do you own your data model?		
Otherwise, who does? Transport Authority / Operators / Integrators/ Other		
Have you defined a way to manage your data model, whether internally or by contracting out?		
Do you own the cryptographic keys of your system?		
Otherwise, who does? Transport Authority / Operators / Integrators / Other		
Is your system based on a modular architecture, with well specified interfaces?		
Does the software on your system use open API?		
Are your system specifications based on a national or international standard?		
Do you have a least two compatible suppliers for every component of your system?		
Are there at least two suppliers of chips for the technology of cards you have chosen?		
Does your system comply with all applicable standards?		
Do you require cards and terminals to be certified when they implement a standard for which certification exists?		
List the certifications you require from suppliers:		

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Calypso Networks Association
would like to thank the contributors to this paper:

Joel Eppe - SNCF

Ralph Gambetta - Smart Ticketing Alliance

Nicolas Generali - CNA

Philippe Guillaumin - CNA

Salah Merzouk - Setim

Jeremy Rubel - RATP Smart Systems

Francis Sykes - RATP Smart Systems

Ludovic Teixeira Costa - Galitt

Philippe Vappereau - CNA

Valentina Zajackowski - CNA

Calypso Networks Association
76 rue Royale – 1000 Brussels
contact@calypsonet-asso.org
www.calypsonet-asso.org