



EMTA **electronic ticketing**

Electronic ticketing in public transport: which criteria for decision-making ?

There are several reasons for Transport Authorities for introducing electronic ticketing systems. Although a topical subject electronic ticketing is still at an early stage of development. Exploring the issues helps making the right choices.

The association of European Metropolitan Transport Authorities (EMTA) brings together the public authorities responsible for planning, coordinating and funding the public transport systems of 32 of the European largest metropolitan areas.

Ticketing is a tool for the implementation of a pricing policy with the consideration of operational, commercial and social objectives. The ticketing system is the translation of fares into concrete means of payment (for the passenger) and fare collection (for the operator).

Electronic ticketing is an automatic fare collection system based on the use of information and communication technologies. Compared to mechanical systems, e-ticketing systems are not only means of payment but also offer a large range of possibilities and data collection that make public transport easier to use, manage and control.

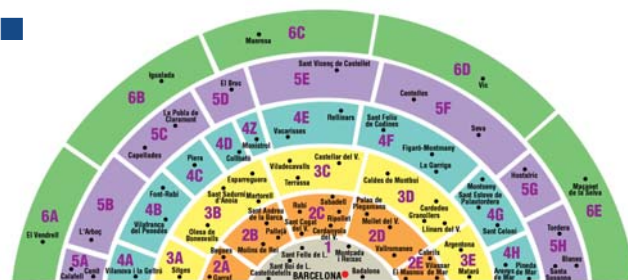
When developing an e-ticketing system, a number of issues must be analysed by the responsible public transport organisation. The output of the analysis will influence the scope and possibilities offered by the system and support the decision-making process.

The EMTA study "Electronic ticketing in public transport" has identified twelve main issues. They are described hereafter.

1. Fare structure

Almost all regions have designed fare zones around the central city. However, fare systems vary according to the area considered for travel. In most cases, a flat fare system is applied in the central city and a zone system is used in the broader city region.

The fare structure is often different for regional and suburban train networks compared to urban rail and buses. In most cases they apply distance-based pricing against zonal or flat fare for urban modes. However, this difference often disappears when an integrated multimodal travel pass is implemented. Moreover, e-ticketing supports the introduction of distance-based fare systems.



There is a general move towards enlarging zones and simplifying the zonal fare system. The introduction of what is called 'convenience tickets' also falls under the trend of simplification.

Fare levels may depend on the payment media or the time of payment. For example, pre-paid tickets are cheaper than tickets bought on board or fares paid with smartcard are cheaper than those paid cash.

Passenger-based fare discrimination exists in all networks either using a market segmentation approach or for social reasons (concessionary fares). By working with target groups, the transport companies sell more season tickets.

Public transport authorities are the only organisations with a broad view on mobility issues in large urban contexts.

¹ Study carried out by a working group composed of representatives from STIF (Paris), YTV (Helsinki), ATM (Barcelona), CTB (Bilbao), TfL (London), MESP (Vilnius), CTM (Madrid), CENTRO (Birmingham), SL (Stockholm), ATM (Montreal), RMV (Frankfurt) and EMTA Secretariat. The study final report was published in June 2008. www.emta.com

2. The responsibility for setting fares

There are mainly three situations:

- Fares are under the responsibility of a unique public transport authority for all modes and operators in the region or metropolitan area;
- The responsibility for setting fares is shared amongst several bodies or administrative layers: the regional authority and/or the central city authority and/or national authority;
- The responsibility for setting fares is mainly with public transport operators, in particular for deregulated markets.

Having an umbrella authority in charge of setting fares does not necessarily mean that the fare structure is simple and easy to understand.

3. Ticketing spectrum

Public transport networks all offer a large spectrum of traditional tickets: single tickets for one or more mode/operator, origin-destination tickets (for regional trips mainly), season tickets (from 1 day to 1 year), multi-journey tickets and tickets corresponding to the concessionary fares.

Season tickets obey to different rules according to the network: in some cases they are valid based on calendar periods (week from Monday to Sunday, month from 1st day to last day); in others validity period starts the first day of validation (7 days or 30 days from the first day of validation); a third category of networks offer more flexibility by allowing the use of a 30-day card within a long period of time (ex: 3 months). Season tickets are generally nominative and not transferable.

Multi-journey cards or multi-tickets books are in some cases limited in duration and in others without time limit which makes their use very flexible.

Value-stored tickets are generally offered with smart-card ticketing but magnetic tickets can also host this facility.

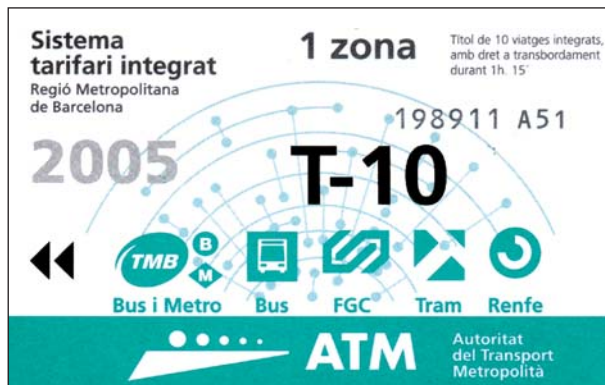
Visitor tickets are offered to tourists and valid from 1 to 7 consecutive days. They are usually more expensive than season tickets of the same duration.

Mode-based fare discrimination makes bus fares different from rail fares for single tickets. In some cities, users can choose a bus-only travel card or a multi-modal pass.

4. Integration

In the context of fare collection, it is important to distinguish between tariff integration and ticket integration. Fare or tariff integration is the possibility offered to passengers to travel from origin to destination by applying the same fare whatever the mode or the operator used and with full transfer rights between modes and operators. Ticket integration is the possi-

bility to use the same ticket (with possible limitation in time) to travel from origin to destination whatever is the mode or operator used and with full transfer rights. It does not prevent to apply different fares according to modes or operators.



Integrated (multi-mode, multi-operator) fare schemes are initiatives taken or at least endorsed by transport authorities to make travel by public transport easy.

Fare integration is treated differently on single tickets compared to season tickets. Single tickets tend to be mode-exclusive (or surface transport vs. heavy rail) while season tickets are in most cases multi-modal. Besides, the more fare-setting is controlled by the authority, the highest fare integration is realized.

E-ticketing makes ticketing integration easier to implement because it can manage a more complex fare system without necessarily harmonising amongst fares of different operators or modes. Each operator or mode keeps its own single fares and the smart-card acts as a unique means of payment.

5. Why e-ticketing?

The following reasons were identified as the main justifications for the introduction of e-ticketing in public transport network:

- limitation of the existing traditional/magnetic system,
- technology obsolescence of existing equipment,
- sociopolitical context and translation of social commitments into a new fare policy,
- implementation of new (innovative) fare policy,
- reduction of fraud,
- increase of passenger loyalty,
- reduction of operating and maintenance costs,
- increase of boarding speeds by reducing transaction times,
- need for integration between modes, regions, operators,
- need to improve the image of public transport.

E-ticketing schemes differ from one city to another according to the pursued objectives:

- A media for season passes: it is mainly developed for loyal passengers (yearly, monthly and now weekly subscribers) to speed boarding to train

and buses and loading of their passes, without necessarily a change in the fare structure.



- A stored-value card: it offers the possibility to pay for single tickets equally.
- A tool making possible to redesign the fare system by introducing distance-based pricing. It implies the implementation of compulsory check-in/check-out procedure in all vehicles or stations.

6. Marketing opportunities

Developing electronic ticketing is an opportunity to introduce innovations in the fare structure which would have not been possible (or hardly) to implement with a traditional ticketing system, such as:

- Fare capping: Rewards the user by ensuring that they pay no more than the fare associated with traditional periodical product concepts via the establishment of daily, weekly or monthly fare caps.
- Frequency-based discounts: The smartcard user is rewarded through receipt of free or discounted journeys once they have made the necessary number of threshold journeys in a specified period.



- Mileage service: It is similar to the principle of airline mileage. Mileage points can be accumulated by the smartcard user each time they use their smartcard for transport or to purchase other services. Collected miles are then converted into value stored on the smartcard.
- Sales channels incentives: The smartcard user is rewarded with a discount for adding value

to their smartcard via the most cost effective channels (e.g. direct debit, internet) as opposed to third party sales outlets and on board.

- Time-of-day pricing: Not a new concept but one that offers significantly greater flexibility for innovative pricing schemes compared to traditional fare media where discounts needed to be hard wired to specific time periods. Peak pricing is a way to partially solve capacity problems.
- Minus ride system: The smartcard user is allowed a one time ride in case the balance of her/his smartcard is not sufficient for a ride. The difference will be reimbursed when they recharge the smartcard.

All above-listed options are likely to attract new customers and increase their loyalty.

7. Exploitation of e-ticketing data

Through mining the e-ticketing-related data, it becomes possible to get the operators' performance statistics: e.g. bus ridership by counting all bus boardings, service frequencies/headways by analysing the time interval between buses, and bus arrival time at bus stops by looking for the first person who taps the smartcard at a bus stop, etc. Mining on the public transport data collected provides valuable information on bus, rail, cards usage and travel patterns, which then could be utilized for policy, planning and marketing usage. This information will be more complete in a check-in/check-out system.

Exploitation of customer-related data raises the privacy issue. The way it is managed depends on the legislation of the country. It will not really have an impact on the type of data collected but on the duration of conservation of these data and on the legal possibility to merge databases making it possible to know actual itineraries of individual customers.

8. Interoperability

According to basic standard for the functional interoperable fare management system architecture (ISO 24014-1, also known as "IFM SA"), there are four different levels of the interoperability concept. Whereas the usage and availability of system and application objects should be analyzed and discussed on level 1 (inter-usability), level 2 (inter-modality), and level 3 (inter-availability), level 4 (interoperability) focuses more on commercial issues rather than on the card technology itself. On levels 1, 2 and 3, commercial agreements are normally only necessary if tickets are distributed and sold through sales agents. Hence, interoperability can be described as the extent to which a travel card issued by one public transport operator can be used by other public transport operators.

The fact that several transport operators work together has a significant impact on the backend system, data model and security framework. To guarantee inter-

operability, all involved transport operators must agree on the following:

- > business rules,
- > rights and duties,
- > roles and responsibilities,
- > clearing to apportion revenues,
- > security & key management.

Other topics that have to be taken into consideration with respect to system-wide interoperability are: card formats and system interfaces.

Thus, it is highly recommended that transport operators use available standards and open specifications (incl. security, data model, transmission, etc.) as much as possible to avoid costly implementation of proprietary and non-compatible systems, which make interoperability impossible.

The implementation of the generic model as defined by the IFM system architecture differs from one situation to another. It depends on the levels of the system that are left open to suppliers and those that have their own proprietary solutions.



9. Standardisation

Referring to standards when defining e-ticketing specifications offer several advantages in terms of sustainability of systems, modularity of its components, interoperability of systems, provision of information to travellers, cost saving, etc. However, these benefits will be lesser when technological evolution will imply to replace equipments or some part of them. The table below summarises the main benefits and disadvantages of opting for standardised systems, according to each type of stakeholder.

Stakeholders	Advantages vs. Disadvantages	
Public Transport Authorities	😊	Nation-wide common technical specifications Better use of financial resources More potential bidders (choices) Compliance of bids Free from any industrial interest
	☹️	Standardised choice Specificities not taken into account
Public transport operators	😊	Continuity and easy integration of existing equipment with new one Optimisation of acquisition and maintenance cost
	☹️	Possible over-costs related to standardisation of new equipment
Industry suppliers	😊	Benefit from standardisation Ensure interoperability Market opening Less specific orders Return on initial investment
	☹️	Harmonisation of equipment (less added value) Certification

10. Business model

Business models depend on the organisation of public transport in the concerned area (single mode or multimodal network, one operator or more and the weight of each operator) and the degree of risk that the organising authority and the operators are willing to take in this field. There are three main situations:

- The organising authority takes the full responsibility to design, implement, run and maintain the future e-ticketing scheme.
- Local transport operators initiate a joint approach to e-ticketing and set-up a joint venture for the implementation and operation of the system.
- A third organisation composed of several stakeholders including the public authority, public transport operators, system suppliers, banks, etc. is responsible for the development and operation of the e-ticketing system.



11. Business case

It is commonly assumed that the implementation of contactless smartcard system will reduce operation and maintenance costs related to ticketing compared to a traditional system. Actually, with the available data, it is not possible to quantitatively demonstrate this assumption. However, it is possible to discuss the cost advantage and disadvantage related to the main elements of a contactless system, as in the table below.

	Cost advantage	Additional cost
Cards / Tickets	Multi-ticket card Value-stored card Multi-application / e-purse Pricing possibilities	Cost of disposable contactless single ticket
Validation	No mechanical parts Shorter transaction time	Coexistence of both systems Metro gating Additional validators
Sales	Automation of sales	Printing of receipts Single tickets
Control	Compulsory validation	Portable control equipment
Customer care	Improved loyalty and CRM	Provision of readers
Back office & Clearing	Shared information system Exploitation of customer data Transparent clearing mechanisms	Network of information On-board equipment for exchange of data
Standardisation Interoperability	Improved integration Open standard / proprietary	Costly and labour intensive at development stage

One very important element which has an impact on the cost is the solution adopted for single tickets. There are five ways of issuing single tickets in an electronic ticketing system:

- Traditional magnetic ticket: in this case, the network will need to keep both contact and contactless validators;
- Disposable smartcard: the cost is approx. 0.2 € which is still very high compared to the cost of the single trip, but it will avoid keeping in operation the traditional ticketing system together with the contactless system;
- Value-stored card: The customer will have to pay a deposit which is generally higher than the cost of the single trip, but is reimbursable;
- Bank card: It needs agreements with the concerned card issuers;
- Mobile phone: It could be through sms or mobile barcode. In this case it implies a telecommunication cost. Contactless payment is possible with NFC mobile phones (to be used as any contactless card) but their number is still very limited.

A cost/benefit assessment and feasibility study of each option is necessary in the decision-making process of an e-ticketing scheme.

12. Clearing mechanisms

The clearing scheme depends on the type of contractual arrangements (if any) between the transport authority and the operator(s): gross cost vs. net cost contract.

In most situations, there is more than one operator and a clearing scheme must be defined in order to remunerate each operator and reflect as much as possible the ridership of each. The issue is all the most important when passengers transfer rights are full amongst operators and integrated ticketing is available.

The most common clearing method is based on counting and surveys carried out on the network to estimate how the different types of tickets are used amongst the various operators' systems. Each ticket type will be assigned a reference price reflecting its use. Based on the number of tickets sold and the related reference price, a total income is determined and then each operator is remunerated according to his share in this income.

Electronic ticketing can assist authority in improving clearing mechanisms by providing detailed information on customers mobility behaviour. If a check-in/check-out procedure is implemented, it becomes easy to distribute revenues according to the actual travel pattern. A direct impact will be a saving on the cost of surveys which are periodically carried out to estimate how the different public transport networks are used.



Conclusion

A number of benefits are expected from the implementation of e-ticketing systems. However, only few public transport networks have carried out 'a posteriori' evaluation of their system and we are therefore lacking return on experience to comprehensively analyse the business case.

There are some fields where e-ticketing offers interesting and proven results: reducing transaction time (ease crowd management), improving knowledge on customers (enhance customer relationship management) and network use (improve and increase transparency of clearing mechanisms)

From the technological perspective, the development of mobile phone technology (NFC) will certainly provide new possibilities for reducing cost of infrastructure and maintenance.

Last, it is essential to remind that e-ticketing remains a tool which could increase efficiency but will never replace a sound management and a clear policy. It should not be reduced to a technology choice but developed as a comprehensive marketing and fare collection solution. To this end, the good will of partners to collaborate is the condition for success.