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E-Ticketing in Public Transit

Models, Applications, and Implementation

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**12th International Conference on Advanced Systems
for Public Transport**

July 22 - 27, 2012 / Santiago de Chile

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Historical development and political framework (1)

- About 40 years ago the discussion starts to introduce cashless payment techniques for fare collection in public transit.
- The beginning was the utilization of the upcoming *information and communication technology (ICT)* in public transit companies and also the increasing market penetration of credit cards as a form of payment.
- During the 80s (also in Germany) different pilot projects are initiated, which however, failed due to technical problems and lack of acceptance.

Historical development and political framework (2)

- With the rise of *radio frequency identification* (RFID) *technology* the framework conditions have changed, especially with development of *near field communication* (NFC) *technology*.
- So for a number of years different approaches are in use, which are successfully established in the market.
- On the political side there is a comprehensive support, on the one side to increase the attractiveness of public transit and on the other side to raise the revenues (to decrease public-law subsidies).

Tariff structures in public transit (1)

Basic parameters are *time* and *space* (with line or space oriented structures).

- *Single tickets* (uniform / distance dependent prices):
 - *One trip ticket* (with / without time limit).
Origin / destination tickets; zonal tickets.
 - *Single ticket with several trips* (with time limit).
Single mode / operator ticket; multi mode / operator ticket.
- *Return and multiple-trip tickets.*
- *Seasonal tickets* (valid e.g. for a day, week, month, or year).

Tariff structures in public transit (2)

- *Group-oriented differentiation:*
(Retirees, children, pupils, and students as well as unemployed and handicapped persons)
- (Quantity-related) *group tickets* and (time of day-related) *off-peak tickets*.
- *Resulting problems:*
 - *Complex (as well as unclear and confusing) structures from customers point of view.*
 - *Customer orientation vs. transparency and comprehensibility.*

Objectives and requirements in e-ticketing (1/1)

- *Objectives of authorities for public transport supply:*
 - *Simple tariff structures and reasonable fares (in accordance with the social circumstances).*
 - *Avoiding (or reducing) subsidies for investments and operational costs as well as reducing compensations from not cost-covering social tariffs.*
- *Operating companies:*
 - **Provision of public transport services under the principle of cost-effectiveness.**
 - **Satisfying specified quality standards.**
 - **Increase in demand to raise revenues.**

Objectives and requirements in e-ticketing (1/2)

- *(Potential) customers:*
 - Quantitative and qualitative high-value transport services.
 - Most favorable fares and conditions.
- *Industries and service providers:*
 - Economic interests (improving market shares).
 - *Problems:* Enforcing own interests at the expense of other involved parties; eventually taking into account illegal options (→ corruption).

Objectives and requirements in e-ticketing (2/1)

- Defining *objectives* and *conceptual design*:
 - Planned *service area* (on single or multi operator-level, on public transit association-level; national / international cooperation, etc.). (→ standardization)
 - Determining the *participating partners* and *conceptual design* of cooperation.
- Design of the *system functionality*:
 - *Core function*: Efficient and cost-saving fare collection.
 - *Public transit related functionalities*: Payment of services as e.g. P+R and CarSharing.
 - *Additional functionalities*: Payments for public services, cultural events and / or leisure, etc.

Objectives and requirements in e-ticketing (2/2)

- Design of the *technical framework*:
 - Technical *infrastructure* (stationary infrastructure, rolling stock equipment, etc.).
 - Information and communication systems.
- Development of a *financing concept*.
- Development of an *implementation strategy*.

To achieve considerable *market penetration* in a short time, it is appropriate that the functionalities should concentrate on *core areas*. Moreover, other objectives are to respond to potential critics as well as to fears of possible risks.

Realizations and acceptance (1)

- In recent years more and more systems have been implemented all over the world (mainly based on smartcards).
- Different concepts are realized, e.g. single- and multi-operator oriented systems are in operation.
- Increased availability of mobile phone-based solutions (as an additional offer).
- Necessary technologies are *available* and *subjected* to *continuous development*.

Realizations and acceptance (2/1)

Transport mode-related application:



Metro Moscow



Realizations and acceptance (2/2)

Service area-related application (1):



(Standard card)

Octopus Card / Hong Kong



(Children card)

Realizations and acceptance (2/3)

Service area-related application (2):

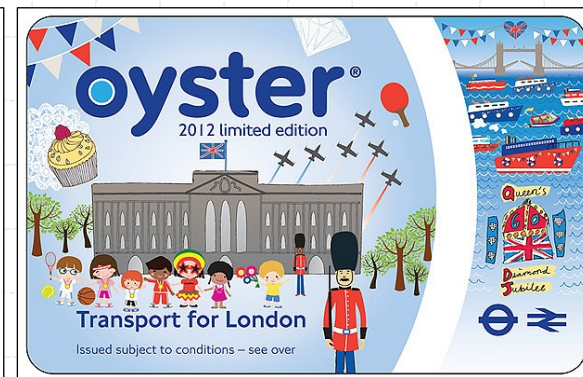
Oyster Card / London



(Standard card)



(Event-based cards)

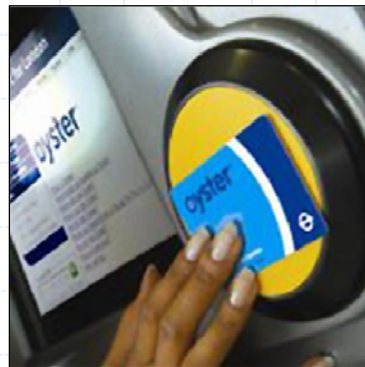


Realizations and acceptance (3/1)

Stationary technical installations (1):



Entrance gates for Metro stations (MRT / Hong Kong)



Access points (London Underground)

Realizations and acceptance (3/2)

Stationary technical installations (2):



Access point and access control Nederlandse Spoorwegen (NS)

Access control system (Oslo / Norway)



Access control system Octopus (Hong Kong)



Realizations and acceptance (3/3)

On-board technical installations:



On-board equipment (MTA / New York)



On-board equipment (Sao Paulo)

Realizations and acceptance (4)

Mobile phone-based installations:



**Touch & Travel system
(Germany)**



**Suica Card
(Kyoto / Japan)**



Realizations and acceptance (5)

- *Fundamental resistance against electronic-based applications:*
 - **Uncertainty about unknown risks.**
 - **Aversions against technological innovation (fundamental hostility towards new technologies).**
- *Problems in data security and privacy:*
 - **(Technical) data security (data losses, etc.).**
 - **Data misuse (unauthorized data transfer to third parties, etc.).**
 - **Unauthorized access to personal data, etc. (→ the "transparent citizen").**

Implementation examples (1/1)

- **Example 1: *Hamburger Verkehrsverbund (HVV)*.**



Implementation examples (1/2)

- **Example 1: *Hamburger Verkehrsverbund (HVV)*.**
 - **Project start: November 23, 2011**
 - **Project name: *Vorteil 25 (Advantage 25)*.**
 - **Target group: Occasional users.**
 - **Price for the smartcard: 10,00 €.**
 - **Advantage: 25% fare reduction per trip.**
 - **Technical problems resulting from different IT architectures and software systems of the partners.**
 - **Necessity to implement a superior IT layer to integrate the incompatible systems.**

Implementation examples (1/2)

- **Example 1: *Hamburger Verkehrsverbund (HVV)*.**

Current solution seems insufficient:

- **Price per card (10,00 €) may be economically unattractive for occasional users.**
- **For (potential) customers with short stay within the service area the offer seems unattractive.**

Possible adaptation :

- **Reducing the card price (or establishing a deposit) and lower fare reduction.**
- **Incorporating weekly or monthly cards applying best price calculation.**

Implementation examples (2/1)

- **Example 2: Verkehrsverbund Berlin-Brandenburg (VBB).**



(A first attempt (about ten years ago) to introduce smartcards was cancelled for political reasons. The underlying tariff model was not accepted.)

- **Project start: 2011**
- **Project name: *fahrCard***
- **Focus group: (Selected) monthly card holders within the VBB network.**

Implementation examples (2/2)

- **Example 2: *Verkehrsverbund Berlin-Brandenburg (VBB)*.**
 - **Keeping existing tariff structures.**
 - **Technical changeover of fare collection as the main project objective.**
 - **Stepwise establishment of a new *technical basics* for fare collection (*infrastructure, rolling stock*).**
 - **In the case that a complete (*technical*) covering of the service area is available other tariff offers should be included into this concept as well as new offers.**

Conclusions and outlook (1)

- *Customer orientation:*
 - Offering simplified and clearly designed systems as well as user interfaces.
 - The systems should be helpfully for customer loyalty and the acquisition of new customers.
- *Establishment of open systems:*
 - Sufficient flexibility to integrate new technological developments.
 - Open structures to incorporate new participants and / or to extend the service area.

Conclusions and outlook (2)

- *Long-termed guarantee of cost-effectiveness:*
 - Implementation of *electronic fare management systems* requires comprehensive input and considerable investments, which need subsidies during the initial phase.
 - From a long-term point of view such systems must operate cost-covering.
- *Organizational structures and responsibilities:*
 - With regard to the different partners involved in such projects it is useful to install an independent (and neutral) operating company.
 - This company must be responsible for the whole system without any exceptions.

Conclusions and outlook (3)

The realization of such a concept must be made consistently and extensively. A continuing existence of other fare collecting systems has to be avoided, not only for economic reasons but also with a view to a uniform and attractive appearance public transit.



Conclusions and outlook (4)

In addition it must be seen that public transit is an important part of the service of general public interest, so the *responsibility* of political and public-law authorities has to be taken into consideration.

Moreover, it should be considered that the *political will* and / or the *technical feasibility* can not provide a sufficient basis to implement an *electronic fare management system*. If the operating cost can only be covered in a long-term view with the help of subsidies, such a solution is not acceptable.