

Summary

Public transport comprises all transport systems in which the passengers do not travel in their own vehicles. When a person wants to ride with public transport (PT) a fare usually has to be paid. Therefore a public transport operator has to set up a ticketing and payment system, in other words: a fare collection system. Before 1970 this fare was collected mostly manually in cash and with paper tickets.

Between then and now new technologies have not only increased the ways of collecting fare, but also made automation and interoperability with other applications possible. This interoperability, the ability of diverse systems to work together, is investigated in this literature study. The expansion options of the Dutch public transit payment and ticketing subsystem to be interoperable with other subsystems in a larger system are investigated. Before these options are examined it is important to understand the basis of fare collection.

The essence of a fare collection system remains the same no matter the physical interpretation of the conceptual system. It involves around the same three stakeholders and their requirements: the public transport operators, authorities and the population. A fare collection system always consists of the following components for which the filling in has to be determined: fare structure or policy, fare type, fare media, fare collection procedures and fare collection equipment or technology.

The ways of filling in the physical interpretation of this structure are explained in this report and over the years these ways have increased through technological developments. Modern fare collection systems are mostly automated with contactless smartcards or mobile phones as fare media combined with electronic payment and ticketing. These e-ticketing systems are automated electronic fare collection systems with support systems that offer several advantages. These advantages for the main three stakeholders are mentioned as well as the general system architecture required for the system. For interoperability it is preferred that this system architecture can work together with components of other systems. Several types of interoperability are mentioned that need to be taken into account when designing or expanding an e-ticketing system.

The focus of this study is on the expansion through interoperability of the e-ticketing system in the Netherlands, called the "OV-chipkaart systeem". The background on the introduction of this system is given as well as the environment and requirements. This is followed by the Dutch physical interpretation of the fare collection system to understand the possibilities for expansion of the e-ticketing system. The Dutch e-ticketing system comprises of contactless smartcard fare media with a system architecture of four levels which is currently only used for public transport.

To extend the use of the system architecture for other transportation sectors or other industries the options need to be mapped out. The builder of the Dutch e-ticketing system, TLS, has indicated four several new major trends for expansion. As TLS is still trying to fully implement the Dutch e-ticketing system nationally expansion is not their primary focus.

In the future TLS considers the following options to evolve the OV-chipkaart to a multi-purpose card (1)(2):

- Expand use of the OV-chipkaart in the mobility chain: parking, bicycle rent, taxi
- Multi-application and integration of applications: transport, payment, access, events
- Facilitate low-value retail payments (retailers in and around public transport locations such as stations)
- Potential integration with other cards and/or (payment)applications
- Cooperation with other Dutch schemes or banks

If the implementation of these trends is considered the following two situations can arise in the Dutch e-ticketing system architecture:

- Extending the current system architecture under management of TLS
- Replacing and adding (parts of) the current system architecture which will be managed by other parties

For these two situations several expansion options exist for the e-ticketing system to become a subsystem of a broader multifunctional system. These options could include cooperation with banks, mobile network operators and other stakeholders at different levels of system architecture. Three systems are likely to be formed:

- Enhanced payment card industry systems that incorporate an intermediate back office step.
- Basic combined systems that use contactless media.
- Enhanced combined systems that give customers a choice of fare payment methods.

The media used in the multifunctional system in these three systems include contactless bankcards, the OV-chipkaart, mobile phones or other contactless devices. Also the system architecture used could be TLS' , a mobile operator's or a bank's system or a combination of several.

By looking broader to evolve the fare collection system to a multifunctional system outside public transit it has become clear that many options are available. The conclusion can be drawn that broader systems with mobile phones with contactless communication chips will be the most likely and most convenient solution to evolve towards. In the meantime the other systems discussed will be good intermediate solutions.

These broader systems will not replace the current Dutch integrated ticketing system, but will make the boundaries open up and make the Dutch system interoperable with other customer applications, functions, media and channels. This new broader system will be the future of the fare collection in the Netherlands and possible functions such as ticketing, payment, access control, communication, sharing, purchasing and entertainment.