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Intelligent transport systems — Common Transport Service Account Systems —

Part 1: Framework and use cases

Partie 1: Cadre et cas d'utilisation

PROOF/ÉPREUVE

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Foreword

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This document was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*.

A list of all parts in the ISO 21724 series can be found on the ISO website.

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Introduction

Many transportation services (e.g. public transport, tolled roads, parking, city bike rental etc.) require payment for use. This has previously caused each service provider (e.g. public transport authorities, toll authorities, public and private parking providers, etc.) to develop independent, stand-alone payment systems to enable users to pay for access to their service. Consequently, a traveller who traverses multiple transport modes had to purchase services at more than one point of sales location. If the payment systems are integrated, then the transport service user may possess more than one payment/ticketing media, application, and/or account. However, in public transport there have for many years been products that enable a traveller to benefit from a seamless journey from A to B using several transport means, modes and operators. These products have been available through cooperation between operators and regional and national tariff schemes.

The transportation industry has seen an evolution in the collection of fares and fees throughout its history. The main drivers of that evolution have been the pursuit of increases in customer convenience and system efficiencies. Automated Fare Collection has progressed from use of magnetic technology to contactless smart cards, and recently to open financial payments and mobile payment applications.

Automated Toll Collection began with the use of simple read-only tags and is now looking to new approaches and technologies for future payment system advancements. Examples are open road tolling, vehicle miles travelled methods, and technologies such as Dedicated Short Range Communications (DSRC), Global Navigation Satellite System (GNSS), and Cellular Networks (e.g., GSM). Agencies have used these high-technology systems not only to enable automated payment and speed throughput, but to capture data, improve system reliability, and perhaps most important, to improve customer service.

Historically, transportation payment systems have covered only one service provider. Therefore, public transport ticketing/payment systems has not typically been technically integrated with charging/payment systems for tolls or parking and vice-versa. The reasons for this isolated nature are twofold. The first is that the individual service providers had little interest, from a business case standpoint, in integrating their purpose-built ticketing-, charging- and payment systems. The second is that technically this is a difficult and costly exercise, owing to the fact that the systems are typically proprietary and were designed to enable payment for one transportation service. However, in public transport more and more electronic ticketing systems are supporting communication in compliance with ISO/IEC 14443 or ISO/IEC 18092. This implies physical and technical interoperability but also the ticketing applications have to be interoperable as well as there has to be a contractual interoperability.

Some integration has occurred, for example between commuter or urban rail and parking. A traveller can often pay for both parking and their train ride with a common medium. But these examples usually occur only when there is one transport service provider for both the parking and public transport.

Other examples exist for purpose-built integrations of payment systems across two or more transportation modes. In some Asian countries like Japan and Korea there are several implementations of integrated payment systems for public transport and tolling. Examples include the use of a toll transponder that allows the insertion of a public transport card. The integrated payment systems are mostly based on a common payment media, i.e., smartcard with stored electronic value on the card.

In the past 5 to 10 years, the public transport industry in particular has embraced development of Common Transport Services Account systems. In this approach, transportation products are stored in a central account rather than on the payment media. This architecture allows the system front end to be very flexible to enable customers to use contactless credit and debit cards and contactless mobile payment and ticketing applications alongside transport smart cards.

The subject of this document is to study the convergence of toll fee collection and payment and public transport fare collection and payment through integration of the systems' accounts rather than their fee/fare payment media. This concept is flexible and can also include payment systems for other transport services, such as parking, electric charging stations, rideshare, bikeshare, and other disruptive transportation modes. Using an account-based backoffice architecture (prevalent in the toll industry), is increasingly being used in public transport and other transport service payment systems in the United States and Europe.

The technical approach is to link accounts used in multiple transportation modes to create a common transport service user account. For customers, this creates a seamless, end-to-end experience where they can easily access and pay for all transport modes for which they opt-in: public transport fares, toll fees, rideshare, etc. For operators, this common or linked account allows for additional customer benefits such as incentives, discounts or loyalty points strategies, and can add valuable customer usage data to inform their planning and operations, enhance mobility and reduce congestion in regions.

This document examines the concept, functional requirements, and benefits of converging payment systems for tolling, public transport and other transport services through a central account linkage. Readers interested in how this can be achieved by use of a common media are advised to access ISO/TR 19639.

Intelligent transport systems — Common Transport Service Account Systems —

Part 1: Framework and use cases

1 Scope

This document describes the characteristics of a Common Transport Service Account System (CTSA). It presents the common transport service account framework and associated use cases. The objective of the CTSA role model is to cover relevant transport service, the payment methods, the account types where the user of the service is charged for the service and that requires a more overall role and responsibilities model. The model also defines external stakeholders that impact and border the model, that is, the general financial (banking) system. The framework assumes an account-based system where charges for services are calculated and charged in the account system. The main idea behind the CTSA framework is to provide a transport service user with the benefit of seamless acquisition of access rights to multiple transport services by multiple service / operator managers through a common transport account. This framework assumes a technology-agnostic front end with respect to the payment media and reading equipment. The focus of this framework is the back-office / account management system as a vehicle to integrate multiple transport services and managers.

A new set of terms are introduced in this document to distinguish the convergence of a common approach for payment for transportation services from more traditional models using "smart cards" or electronic tickets. The model describes a move towards common or linked mobility accounts for all traveller payment needs, whether for parking, tolls, public transport and other disruptive mode options (e.g., bikeshare, carshare, microtransit, micromobility), inclusive of commercial payment and benefit models.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

3.1
actor
user playing a coherent set of roles when interacting with the system within a particular *use case* (3.6)

Note 1 to entry: A user can, for instance, be a human, an Organisation or another (sub)system.

3.2
secureID
credential
evidence that a transport service user (customer) is entitled, at the Point of Entry (POE) to the transport service, to benefit from a transport service provided by a transport service manager

Note 1 to entry: The credential or secureID is typically an encrypted token or biometric marker that is uniquely associated with a user's identification.

Note 2 to entry: A secureID may consist of a set of data elements defined in a standardized format stored on an electronic media, e.g. a smartphone, used for a secure storage of the information and a secure communication of the information to the media accepting devices installed either at the POE or at the Point of Sales (POS). The set of data elements and their content (values) can vary depending on the type of payment method, type of media and credential application stored on the media and the type of transport service provided.

Note 3 to entry: A secureID may consist of a simple vehicle ID as given by the vehicle number plate and read by the roadside equipment (RSE) by means of Automatic Number Plate Recognition (ANPR).

Note 4 to entry: A secureID may also consist of a biometric identification, e.g. finger-print or facial recognition of the transport service user.

3.3
open interface
public standard (or generally accepted specification) for connecting hardware to hardware and software to software

[SOURCE: https://encyclopedia2.thefreedictionary.com/open+interface, 22 March 2016]

3.4
open payment
use of open industry interface standards and specifications for the electronic remuneration and provision of transport services

Note 1 to entry: See Reference [7] for more information on open payment architecture.

3.5
payment method
timing and location of remuneration for services including whether the payment is required prior to, at the time of, or post access to transport or related services

3.6
use case
description of typical interactions between the *actors* (3.1) and the (sub)system itself, capturing the functional requirements of the (sub)system by defining a sequence of actions performed by one or more actors and the system

4 Abbreviations

ANPR	automatic number plate recognition
EFC	electronic fee collection
IFMS	integrated fare management system
IFMSA	integrated fare management system architecture
PAYG	pay as you go
POE	point of entry
POS	point of sale
RSE	roadside equipment
TCRP	Transit Cooperative Research Program (a program sponsored by the United States National Academy of Sciences)

5 Common Transport Services Account overview

5.1 General

This clause presents the Common Transport Services Account System framework and architecture. This clause includes the definition, requirements, role model and role descriptions, modes, and flows of the system. These components are described in more detail in the following subclauses. The objective

of the CTSA role model is to cover any transport service where the user of the service is charged for the service and that requires a more overall role and responsibilities model.

5.2 Common Transport Services Account definition

A CTSA system is characterized by the use of open interfaces for validating payment and a transport account management system ('back-office') for processing and managing secureIDs, transport service user products and value stores for multiple transport service and operator managers. The back-office processes ensure privacy, security and portability of secureIDs to support current and expanded integrated services offered by multiple transport service managers.

In general, a Common Transport Service Account system conducts the majority of the validation and authentication of user payment and access rights to service in the back-office; the secureIDs and media used by a traveller is typically used for identification purposes only. The value is not typically contained on the media, and under normal circumstances (when communications is available), the fee or fare calculations are not calculated in the media reader.

5.3 Common Transport Service Account concept

The concept of a CTSA is for a traveller to seamlessly travel from origin to destination while using the most convenient means of gaining service access rights. As depicted in Figure 1, a traveller may join one or more transport service or operation managers and also link the most appropriate secureIDs to gain access to transport services via their account.

Service access rights processing is performed in the account back-office, which enables systems to be loosely integrated where they do not need to share the same equipment types, technologies, applications, or customer media form factors. The flexibility provides customers with choosing their preferred service modes, payment and credential methods, as well as the ability to migrate to new technologies as they are deployed. They are able to use the most convenient means to access services, provided their secureID is based on an open interface, and the operations manager is able to process the link that their secureID provides to the back-office customer account.

EXAMPLE 1 A toll operator can require that a traveller register a licence plate and establish a stored value purse to pay for travel on toll lanes; a bikeshare service can require a monthly fee and bank card of record for a guarantee; a parking vendor can provide discounts for rail travellers, and a commuter rail service can require tickets or passes for travel. With the CTSA, the traveller has a one-stop location to register all the appropriate secureIDs, create a single travel purse, store a single card for all transactions, and register for benefits or discounts that are available for using public or active transport alternatives. The customer can better manage their travel history. Meanwhile, service managers can better manage transportation alternatives for customers, offer discounts for changing travel choices, and coordinate network management scenarios to more effectively meet demand.

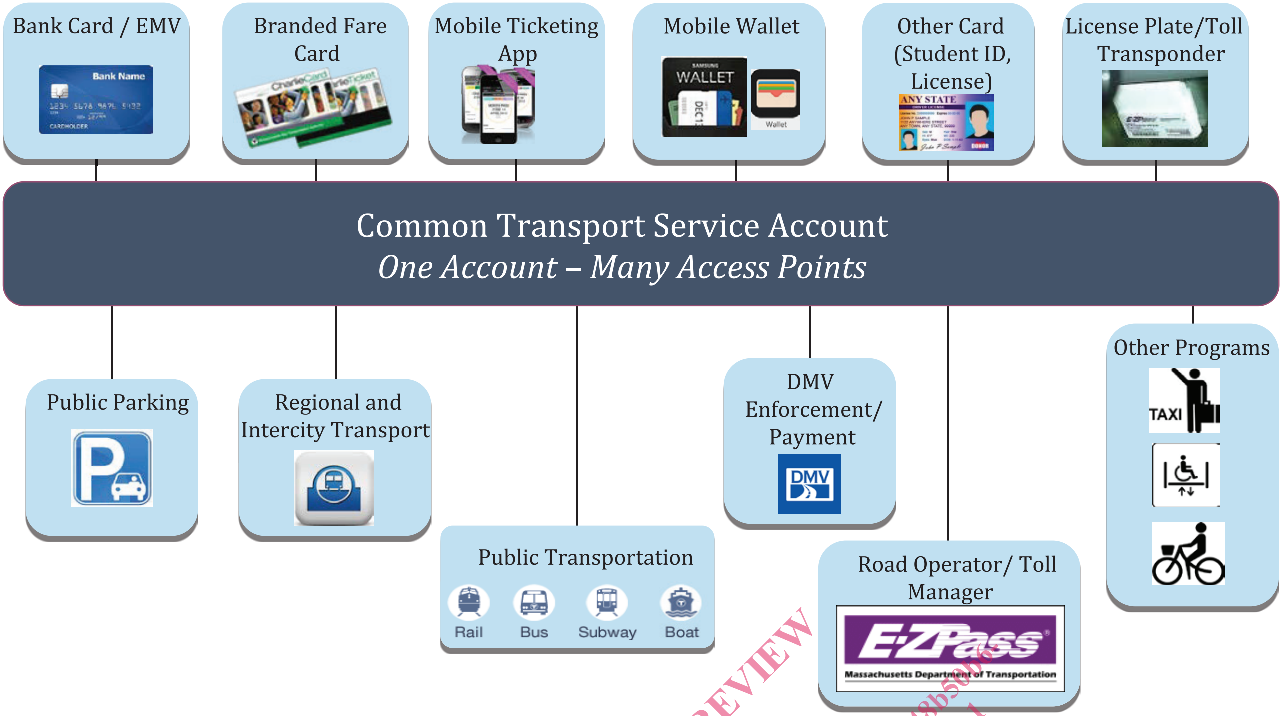

Figure 1 — Common Transport Service Account concept

Specifically, the idea behind the CTSA is to provide the transport service user with a framework where the transport service user benefits from many types of transport services without having several interfaces with different financial service providers, e.g., banks and credit card companies supporting the different transport service providers. The transport service user is able to receive one invoice with all the charging transactions for all the transport services used. Every time the transport service user benefits from a transport service, the validation of his travel service rights (secureIDs) is collected and transferred to the manager of the Common Transport Service Account. The CTSA manager settles the transport service user account based on the transport services consumed and the commercial rules relevant for the services or combination of services consumed. Hence, the whole concept is based on a transport related central account and an identification of the transport service user and his/her secureID. The following more complex example may describe the concept of CTSA:

A transport service user benefits every day from three types of transport services. The first one relates to the use of a tolled highway to a city. The second transport service is the use of parking services at a Park&Ride terminal and the third service is the use of a bus line from the Park&Ride terminal to the city centre. The transport service user uses an on-board equipment (electronic tag) with a post-paid central account for the electronic fee collection (EFC) on the tolled road, a smartcard with a pre-paid central account for access to the parking lot and a fare medium with a pre-paid period pass for riding with the bus. Every month, the transport service user receives an invoice from each of the three different transport service providers. There are no links or relationships between the three transport service providers enabling the user to benefit from the combination of transport services or to have one invoice covering all transport services.

The three transport service providers then agree to join forces, making the usage of transport services more user-friendly concerning charging and invoicing. They establish a joint venture association and enable the user to have a CTSA managed by the joint venture association. The CTSA manager (the joint venture association) receives the proof of usage (validation of secureIDs) from each of the three transport service providers and settles the user's CTSA once a month, enabling the user to have specific rates for his/her combined usage of transport services. The user then receives one invoice each month with the documentation of his/her transport service usage and one amount to be paid.

It should be noted that the CTSA manager does not act as a financial service provider, e.g., a bank or credit card company. The CTSA manager is primarily a clearing and forwarding entity that belongs to the transport domain and that clears and settles the CTSAs linked to each of the transport service users that have a CTSA contract enabling them to have one common account for all their usage of transport services. The CTSA manager also settles financial accounts between different stakeholders in the transport domain involved in the CTSA concept. There are only a few disparate systems in place today that can support a CTSA. This framework will provide a blueprint for others to migrate to an account-based system that supporst multiple service and operations managers.

5.4 CTSA requirements

The CTSA system is characterized by the following requirements:

1) A CTSA system enables a transport service user to hold one account from which to pay for service rights to a variety of linked or unlinked transport services from one or more transport operators including vehicle, public transport, rail, taxi, electric charging, parking, shared use transport and other mobility providers.

2) A CTSA system enables a registered transport service user to use their most convenient secureID to pay on entry/exit or to acquire transport service rights from a variety of transport operators. Examples of a secureID may include licence plate, government identification cards, private label media that conform to open interface standard formats, bank cards or virtual bank cards stored in mobile phones, or payment services such as Apple Pay and PayPal, and emerging technologies.

3) A transport service user's registered secureID may be used on a transport service when a payment method or transport product is associated with the secureID.

4) A multimodal journey that may include travel across toll roads, public transport, parking, shared use mobility aids and systems may be linked across different service and operation managers to provide travel or other benefits or discounts to the transport service user.

5) A CTSA system enables a transport operator to act as a typical payment merchant with respect to a transport service user, wherein pay as you go (PAYG) for services model is used.

6) In a CTSA system, a payment is made using open interface standards.

7) A CTSA system allows point of entry and point of sales locations to co-exist at the same location.

8) A CTSA system allows information about transport service user accounts to be shared among other service providers based on a transport service user agreement (opt-in/opt-out) at any time during membership/registration to the service.

9) A CTSA system allows an entity/actor to extract data appropriate to revenue sharing and statistical requirements of transport service user usage, transactions and access to services.

10) The CTSA model should be capable of extending the use to different POE and POS technologies, including passive and active reader methods.

11) The CTSA model should be structured to accommodate current best practices to prevent internal and external fraud and to safeguard the revenue collection by the appropriate service providers.

12) The CTSA model should protect transport service user privacy.

NOTE Passive and active reader methods are based on whether a customer actively presents a secureID to a reader (active method) or a "reader" senses its presence (passive method).

5.5 Transport service requirements

This subclause describes the modes and services for which payment is charged for usage. Within the four basic transport modes, road, rail, sea, and air, we focus on the road, rail or sea. Due to their structure, these modes have different requirements that drive the secureID technology, media, transaction type,

and transmission performance. In this model, the traveller service discovery, reservations, sales and provisioning of secureIDs for access is also included in transport service requirements due to the choices available to travellers. For that reason, transport service requirements also includes a service called: Information and Reservation Service Provider. The transport modes and their requirements are listed in Table 1.

Table 1 — Transport mode requirements

Mode/Service	Requirements
Road/Tolled infrastructure	Need for display/transmission of secureIDs at a distance from POE while vehicle is moving. Need to enforce vehicle secureIDs passively from vehicle or transmitted from vehicle (e.g., licence plate cameras or via transmission to RSE)
Road/Public transport services	Need for fast transaction times. Need to transact micropayments. Need to operate in a barrier or barrier-free mode.
Rail/Subway and metro services	Need for fast transaction times. Need to transact micropayments. Need to operate in a barrier or barrier-free mode.
Road/Parking, Shared-use mobile services (bicycle and car-sharing services)	Need for intermodal transfers and sharing secureID/access/benefit information (e.g., car park, bike sharing, bike storage, car share). Need to operate using different enforcement provisions such as lock, gate, or inspection.
Road/Long distance bus Road/Car sharing Road/Charging station electric vehicles Rail/Train services Sea/Ferry	Although limited real time need, Need for fast transaction times. Need for estimate of number of travellers/users per "trip". (Optional) Need for payment inspection and enforcement.
Information and Reservation Service Provider	Although limited real time need, need for fast transaction times. Need for interfaces to product, service fee, fare, and service transfer rules. Need for reciprocity and discount/benefit rules.

6 CTSA system framework model

6.1 General

The CTSA system framework model overlaps with the IFMS framework (ISO 24014-1) and EFC models (ISO 17573 series), although the secureID Registrar role is replaced with a financial service provider. Details of the relationship between the CTSA and IFMS and CTSA and EFC are described in 6.3.

The framework model is shown in Figure 2. The framework is composed of six main actors or entities, as described in Table 2. The enumerated data flows (e.g., 1. Display/Actuate), show the major data exchanges between actors. These flows are described in 6.2.

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