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Electronic fee collection — Requirements for EFC application interfaces on common media

Perception du télépéage — Exigences relatives aux interfaces d'application de télépéage sur média commun

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

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

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Transportation network improvement, including road and railway, is essential to drive economic growth. Integrated transport service has been aimed at topics such as user convenience, transport safety, reliability, efficiency and availability. For example, a traffic manager can find which kinds of improvements are needed to relieve traffic bottlenecks by analysing user transport flows in a transport system considered as a whole.

It is usually necessary to use different transport services to transfer people or goods from origin to destination. Sometimes, using different transport services in the same trip becomes cumbersome when transport services are operated by different operators, e.g. bad interconnections between different transport modes due to user needs to search and compare transportation modes, need for separate charging or payment for the transport services used. The connections between different transport modes and the means to achieve seamless travel are improving with the use of information and communication technologies (ICT).

ISO/TR 19639 investigated case studies on the use of a common payment medium when combining public transport services and road services, based on the use of a common payment schema. This common payment schema is further categorised into integrated central accounts and integrated on-board accounts.

ISO/TR 19639 concluded by stating the need for new electronic fee collection (EFC) standards to support on-board integrated accounts, among which is an application interface between the common payment medium and the common service rights provider (CSRP). The background of on-board accounts in EFC are:

— Operational methods of EFC systems might be different due to regional and local circumstances. EFC systems can be classified into central accounts and on-board accounts, using a common payment medium, which are widely adopted in Asian countries.

— On-board account payment media are commonly used for public transport in several countries, e.g. Singapore, Malaysia and China.

— Central payment accounts are considered one of the common service rights methods explained in ISO/TR 20526, whereas the EFC standards are currently predominantly based on a central account.

— A convergence on the usage of on-board account for both EFC systems and public transport should be considered.

This document describes an EFC application as one type of transport service specific application and the application interface requirements for a common service rights application. A common service rights application is explained in informative Annex C of this document for understanding a common payment scheme based on this concept as shown in Figure 1.

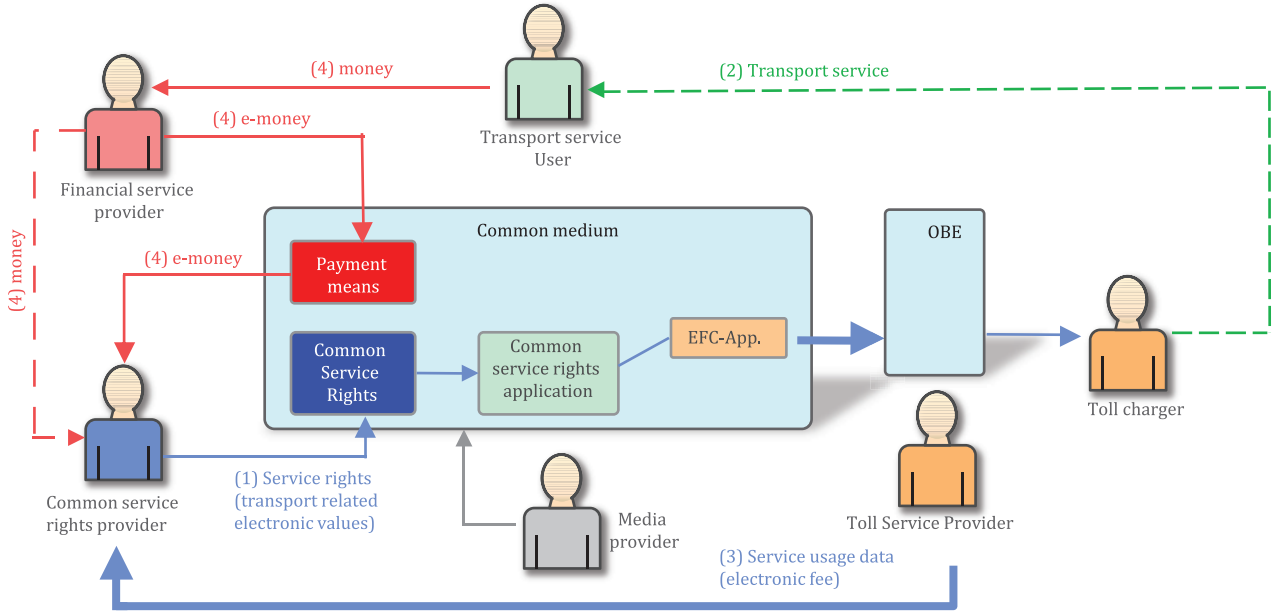

Figure 1 — Common payment medium concept for EFC scheme

Arrow lines (4) labelled 'money' and 'e-money' are monetary flows and out scope of this document.

Arrow line (2) labelled 'Transport service' is not an ICT interface but a physical transport service.

Other arrow lines are in the scope of ISO/TC 204 (EFC and public transport standards) and the thick arrow line between common payment medium and OBE is within the scope of this document.

This document will extend the set of EFC standards to allow provisions for multi-modal transport services by using a common payment medium.

This document defines among others, the role and responsibilities of a CSRP. The CSRP provides a common payment medium for enabling use of EFC, a public transport service and retail shopping service to service users with one account. CSRP may provide the usage record of user's multi modal transport trip as a form of customer service.

This document contains a number of annexes. Data type specifications are given in Annex A, an implementation conformance statement (ICS) proforma is given in Annex B. The common payment medium concept for any transport service is presented in Annex C. General kinds of application structure in a medium are presented in Annex D. General requirements from medium relating standards is presented in Annex E. A typical system migration method and technical solution supporting medium upgrading are presented in Annex F. Examples of reloading types and transactions are presented in Annex G. The EFC security requirements for a common payment medium are presented in Annex H based on EFC functional requirements.

The scope of this document includes an EFC application interface for a common payment medium as shown in Figure 2, as well as the role and responsibilities of a Common Service Rights Provider (CSRP).

NOTE Figure 2 explains the relation of CSRP among related sectors including EFC. E-money is exchanged between the Transport Service Provider (TSP) in the EFC sector and the CSRP. E-money is exchanged between retail in the commerce sector and the CSRP.

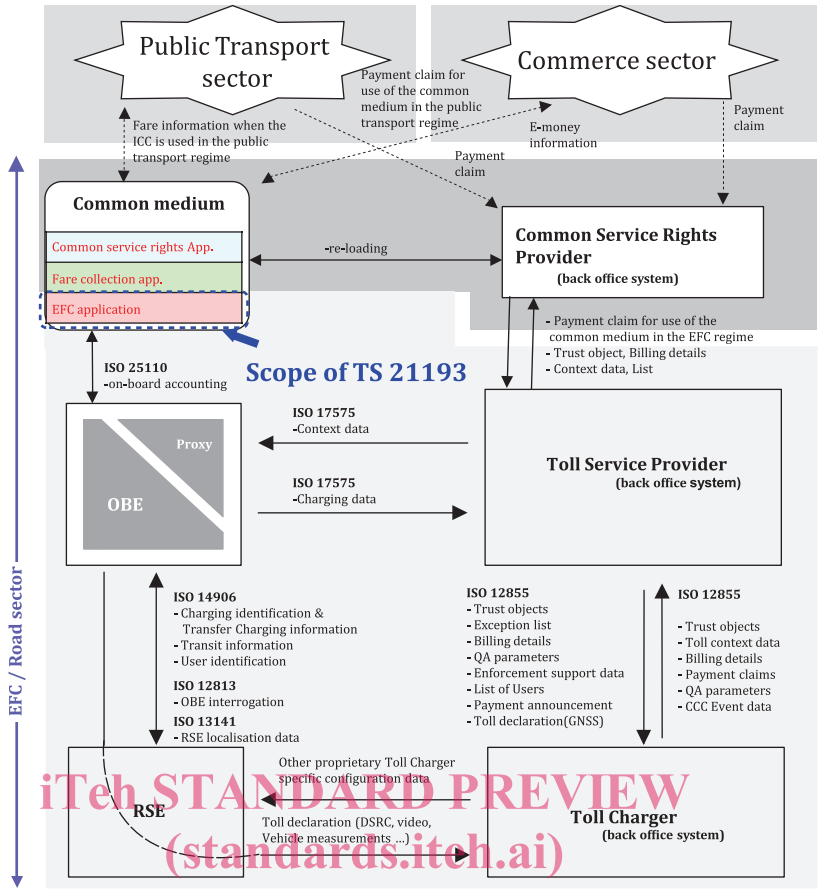

Figure 2 — Scope within the EFC computational architecture

Electronic fee collection — Requirements for EFC application interfaces on common media

1 Scope

This document defines requirements to support information exchanges among related entities of a common payment scheme. It defines:

a) electronic fee collection (EFC) functional requirements for a common payment medium;

b) an application structure in a common payment medium;

c) EFC application data in a common payment medium.

The following are outside the scope of this document:

— requirements and data definitions for any other transport services such as public transport;

— a complete risk assessment for an EFC system using a common payment medium;

— security issues arising from an EFC application among all transport services;

— the technical trust relationship between a CSRP and a service user;

— concrete implementation specifications for implementation of security for an EFC system;

— detailed specifications required for privacy-friendly EFC implementations;

— any financial transactions of the CSRP.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 14906:2018, *Electronic fee collection — Application interface definition for dedicated short-range communication*

ISO 17573-1:2019, *Electronic fee collection — System architecture for vehicle-related tolling — Part 1: Reference model*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
central account
payment means (3.11) or common service rights in an electronic fee collection (EFC) system, stored in a central system

3.2
common service rights
rights to use services offered by several toll domains or more than one transport mode

EXAMPLE Usage allowance for a number of trips or for a certain time span.

3.3
common service rights provider
CSRP
entity providing *common service rights* (3.2) to the service user

3.4
EFC architecture
description of the key elements of an electronic fee collection (EFC) system, their functions and interrelationships

3.5
electronic money
e-money
value having its equivalence in real money, electronically stored, e.g. in a bank account or an IC-card, which can be used by the user for payments

3.6
fare collection regime
set of rules, including enforcement rules, governing the fare system in the public transport domain

3.7
integrated circuit card
IC card
ICC
card with electronic components performing processing or memory functions with the capability to communicate with an interrogator

Note 1 to entry: Contact IC cards are specified in the ISO/IEC 7816 series of standards, contactless proximity IC cards are specified in the ISO/IEC 14443 series of standards, contactless near-field communication IC cards are specified in ISO/IEC 18092 and ISO/IEC 21481, whereas contactless vicinity IC cards are specified in the ISO/IEC 15693 series of standards.

Note 2 to entry: All references to an IC card are understood to be references to the IC of the card and not to any other storage on the card (e.g. magnetic stripe).

3.8
issuer
entity responsible for issuing the *payment means* (3.11) to the user

3.9
multi-modal transport
the transportation performed with at least two different means of transport

3.10
on-board account
payment means (3.11) or *common service rights* (3.2) in an electronic fee collection (EFC) system, stored on-board either in a *payment medium* (3.12) (e.g. IC card) or in an on-board equipment

3.11
payment means
value in an *on-board account* (3.10) (e.g. cash, tokens or stored electronic values) or a reference to a *central account* (3.1) (e.g. a fleet card, bank account, credit card number or a contract ID) that gives the user access to available services

3.12
payment medium
carrier of *payment means* (3.11)

EXAMPLE Paper ticket, IC-card, smart phone.

3.13
public transport services
shared passenger transport service which is available for use by the public

EXAMPLE Bus, tram, train.

3.14
sensitive EFC data
EFC related data, either the data itself or combined with other EFC related data, that could be used for identifying an EFC user

3.15
toll regime
set of rules, including enforcement rules, governing the collection of a toll in a toll domain

[SOURCE: ISO 17573-1:2019, 3.18]

3.16
transaction model
functional model describing the structure of electronic payment transactions

[SOURCE: ISO 14906:2018, 3.17]

4 Symbols and abbreviated terms

CSR	Common Service Rights
CSRP	Common Service Rights Provider
DSRC	Dedicated Short-Range Communications
EFC	Electronic Fee Collection
ETC	Electronic Toll Collection
OBE	On-Board Equipment
PCI DSS	Payment Card Industry Data Security Standard
PT	Public Transport
RSE	Roadside Equipment
RSU	Roadside Unit
SAM	Secure Access Module
SLA	Service Level Agreement
SU	Service User
TC	Toll Charger
TSP	Transport Service Provider

5 Requirements for a common payment medium

5.1 Requirements for EFC architecture

Any EFC architecture using a common payment medium shall comply with the EFC Roles model defined in ISO 17573-1. The relation of role and responsibility of the "Provision of common service rights" and the EFC role model described in ISO 17573-1 is shown in Figure 3 when enabling interoperability with any transport services. The role of a common service rights provision includes a part of EFC function for EFC regime. As an example, the EFC transaction data described in ISO 14906 and ISO 17575-1 include account information stored in the common payment medium. The EFC role model belongs to the tolling domain and the "Provision of the common service rights" role belongs to another domain, but the two domains are linked together by the use of common service rights in EFC.

NOTE ISO 17573-1 also explains how any EFC-specific common payment medium is used when there is no interoperability with other transport services.

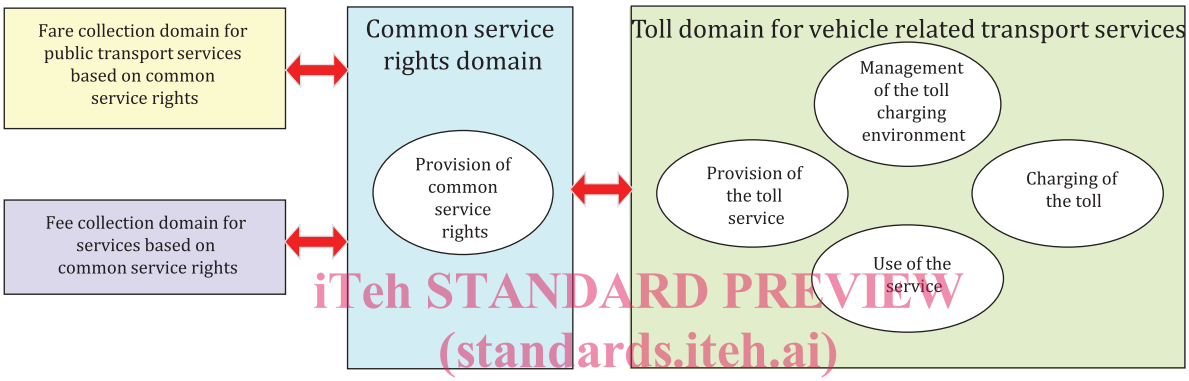

Figure 3 — EFC role model with provision of common service rights

The role related to CSRP is responsible for providing the basic artefacts, mechanism, organizational structure, and information transfer tools needed to integrate an interoperable EFC system into a multi-modal transport system.

Responsibilities related to this role are only restricted to CSRP and include:

— providing basic provision, including

  — providing a common payment medium,

  — guaranteeing that the entity performing the charging of the transport service rights role will be paid for it,

  — providing the common service rights to the user or accepting an existing one,

  — collecting the money from the signer of the EFC service contract and performing reloading transaction for common payment medium,

  — collecting all transport service transactions, clearing and distributing the money to the Transport Service Provider (TSP),

  — managing the customer relationships related to the use of the transport service concerning information, claims, questions and answers, error handling and any contractual or financial matters,

  — implementing and adhering to the security and privacy policies for the transport systems, and

  - monitoring the actual operational quality relative to agreed service level agreements (SLAs);
- acting as a contract agent, including
  - offering contractual relations according to defined conditions to interested users and concluding contractual agreements, and

    The user needs to contract both use of OBE and use of common payment medium for EFC service.
  - providing and managing the transport service contract including the service rights for the toll service user;
- customizing the common payment medium, including
  - customizing the common payment medium in a secure way;
- maintaining the common payment medium, including
  - maintaining the functionality of the common payment medium,
  - maintaining the hot listing of the common payment medium, and
  - performing the refund of values stored on the common payment medium.

A common service right provider may make requirements to the TSP such as protecting some data, security keys and so on for the TSP, toll service provider in an EFC environment.

5.2 EFC functional requirements

While an OBE is generally related to a vehicle, a common payment medium can be carried by the owner/user also for use outside a vehicle. This means that the common payment medium should be considered from the following points of view:

- Enabling the use in all transaction models, for payment modes (pre-pay and/or post pay) and applying security requirements.
- Enabling the use of the EFC service with an OBE.

  NOTE Enabling flexible EFC operation both with OBE and without OBE.
- Enabling confirmation of account information and usage record of service as basic user services.

Based on these viewpoints, requirements are derived for support of a common payment medium, as shown in Table 1.

Table 1 — Basic EFC functional requirements

Functional areas	EFC function item	Functional requirement for a common payment medium
Transaction types	Closed Toll - Entry Transaction Closed Toll - Exit Transaction Open Toll Transaction Transit Transaction Checking Transaction Purse Reloading Transaction	— Common payment medium shall be usable for all transaction types with OBE — Common payment medium shall store EFC contract information — Common payment medium shall securely store a minimum of 3 usage log entries including transaction type and date and time for use of a service — Common payment medium shall store the entry data for closed tolling system with OBE[a]
Payment types	Central Account On-Board Account Pre-Payment Post-Payment Electronic Purse Based Payment Token Based Payment 'Open'(multiple service) Payment System 'Closed'(single service) Payment System No/Zero Payment Refunding	— Common payment medium shall be usable for all payment types — Common payment medium shall be usable for common payment among transport services — Common payment medium shall be usable for reloading transaction if user signed a contract
Contract types	Area Dependent Contract Time Dependent Contract Vehicle Dependent Contract Person Dependent Contract Group of Persons Dependent Contract Anonymous Contract	— Common payment medium shall be usable for all contract types — Common payment medium shall be usable with OBE for vehicle dependent contract since vehicle information is stored in OBE. Otherwise RSE shall detect vehicle information for this contract when only common payment medium is used.
Contract handling	Contract Selection Implicit Contract Explicit Contract Multiple Simultaneous Contracts	— Common payment medium shall be able to store multiple contract information if necessary[b]

[a] This also enables performing flexible EFC operations both with OBE and without OBE.

[b] Multiple application access method is defined in ISO/IEC 7816-4.

Table 1 *(continued)*

Functional areas	EFC function item	Functional requirement for a common payment medium
Security mechanism	One Way Authentication Two Way Authentication Data Integrity Mechanism No Specific Security Segment Integrity Mechanism Signature Based Mechanism Time/Event Based Mechanism Password-based Access Mechanism Encryption Mechanism	— Common payment medium shall implement the required security function(s) — Common service right provider as a common payment medium issuer shall provide secure processing environment to toll service provider
Operational issues	Different gantries configurations Different lane configurations OBE components addressing Alert/Warning information to the customer Dynamic classification Declared classification OBE Transaction Release OBE Remote Switch Off Version Handling Mechanism OBE Capability Handling Mechanism Multi-Application Handling	— Operational requirements when a common payment medium is used in EFC shall be considered before implementation — Common payment medium shall store Version Handling Mechanism — Common payment medium shall be able to be used for Multi-Application Handling — Common payment medium shall store a minimum of 3 usage log entries including transaction type and date and time for the use of a service — Common payment medium shall prevent manipulating the road usage data by user
Tariffing schemes	Distance Dependent Time Dependent Vehicle Dependent Event Dependent Fixed Combined tariffing Scheme	— Tariffing schemes shall be considered whenever a common payment medium stores parameters corresponding to the tariff

[a] This also enables performing flexible EFC operations both with OBE and without OBE.

[b] Multiple application access method is defined in ISO/IEC 7816-4.

The requirements on the common payment medium relating to Payment Card Industry Data Security Standard (PCI DSS) should also be considered as a part of EFC functional requirements. PCI DSS is the security standard of the card industry that was developed for cardholder data protection including technical requirements. Technical requirements relating to an EFC system using a common payment medium are derived from a part of the 12 categories of requirements in PCI DSS. These are described in Table 2.

No actor in an EFC system needs to be certified as PCI DSS compliant.