SLOVENSKI STANDARD
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Elektronsko pobiranje pristojbin - Interoperabilni profili aplikacije za avtonomne sisteme

Electronic fee collection - Interoperable application profiles for autonomous systems

Elektronische Gebührenerhebung - Interoperable Anwendungsprofile für unabhängige Systeme

Perception du télépéage - Profil d'application d'interopérabilité pour les systèmes autonomes

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Electronic fee collection - Interoperable application profiles for autonomous systems

Perception du télépéage - Profil d'application d'interopérabilité pour les systèmes autonomes

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Foreword

This document (CEN/TS 16331:2012) has been prepared by Technical Committee CEN/TC 278 “Road transport and traffic telematics”, the secretariat of which is held by NEN.

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Introduction

This Technical Specification should be used by stakeholders of a group of electronic fee collection (EFC) regimes as a guide when planning to establish or extending an EFC cluster providing interoperability for tolled vehicles in all participating EFC domains.

The scope of this document covers the tolling principles for autonomous EFC systems.

The goal of an interoperable EFC cluster is to ensure that all tolled vehicles can be charged the due toll amount in all EFC domains. This can be achieved by requiring that all necessary equipment, whether in the tolled vehicles, the Toll Service Providers' central systems, the Toll Chargers' central systems and along the roadside in the EFC domains, conform to the same interface standards and to an Interoperable Application Profile, as defined in this Technical Specification.

The system architecture defined in ISO 17573 is the basis for all standards that relate to Electronic Fee Collection systems. It specifies the roles and responsibilities needed within an interoperable EFC cluster. Such a cluster is illustrated in Figure 1, and consists of multiple Toll Service Providers and multiple Toll Chargers. Each Toll Charger has its own EFC Domain and its own EFC regime. Conversely, each Toll Service Provider has a number of clients, who own vehicles and may be liable to pay toll in the EFC domains of the Toll Chargers.

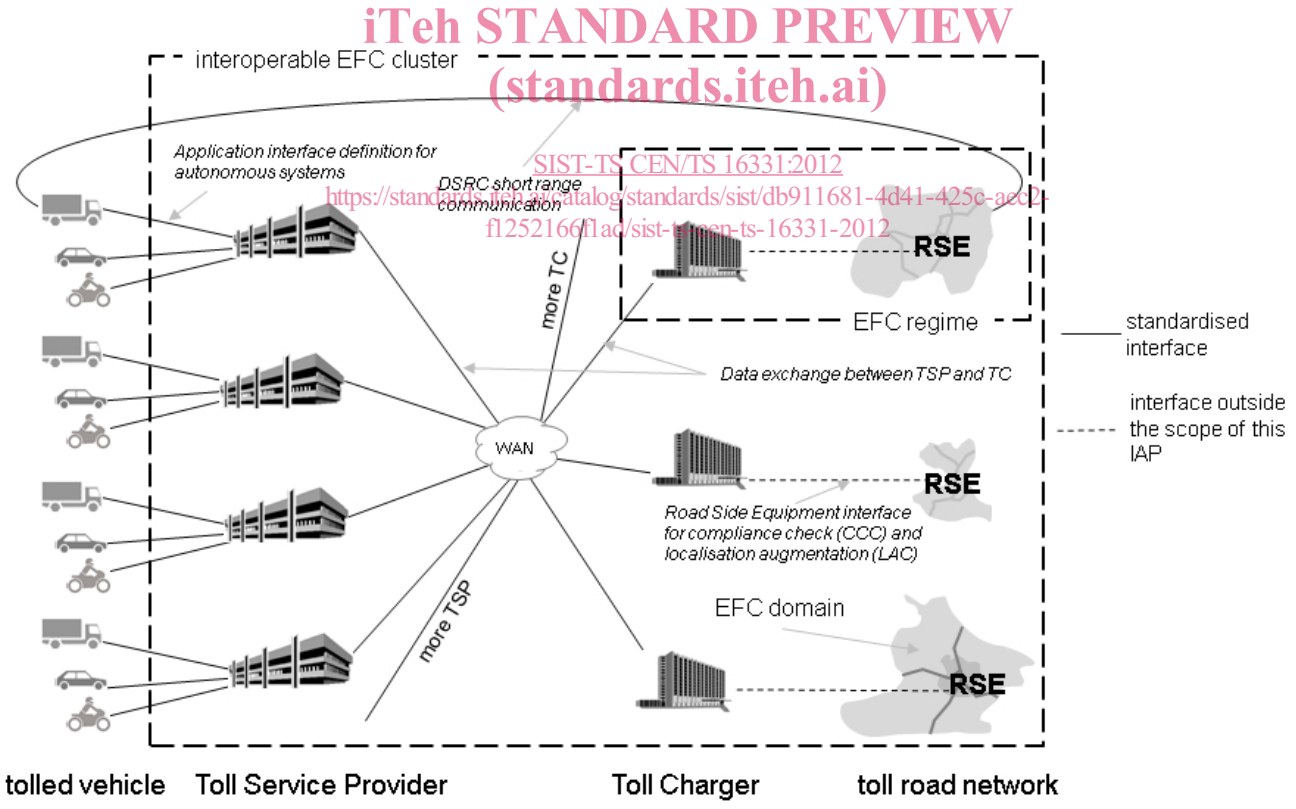

Figure 1 — Actors and interfaces within an interoperable EFC cluster

CEN has produced a set of standards that together specify a basis for EFC systems. This document refers to these standards as the 'base standards'. They are necessary to ensure technical interoperability between different EFC-systems, but in themselves they are not sufficient to achieve this, as they contain a large number of options and choices to be made in a concrete implementation.

Figure 2 shows the base standards and their relationships.

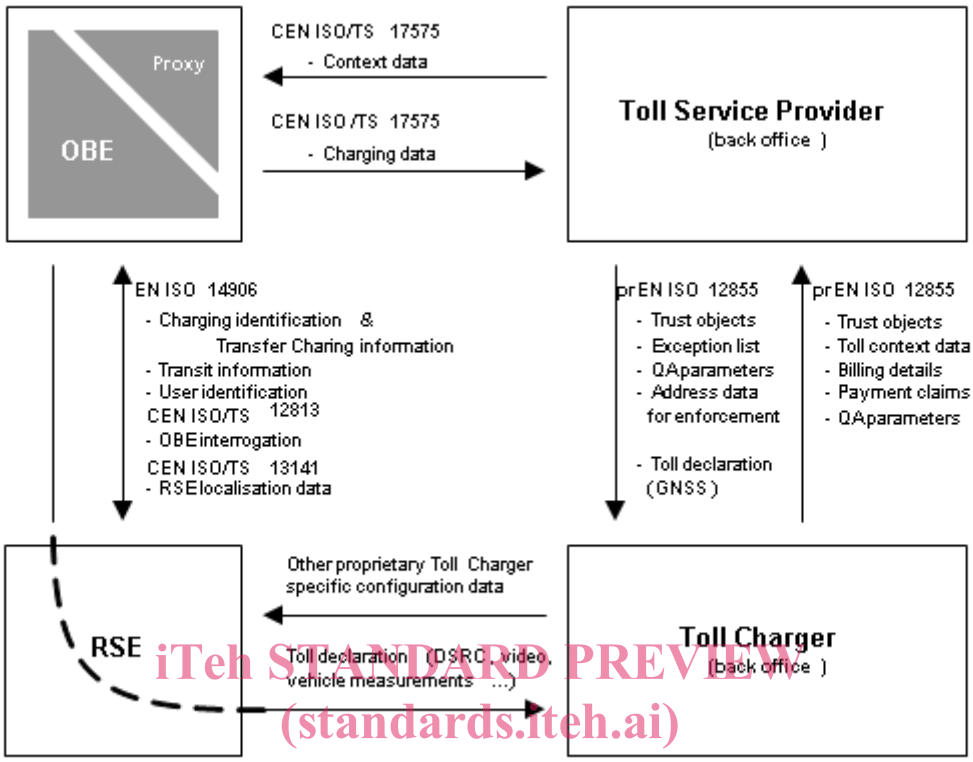

Figure 2 — Suite of EFC related standards

NOTE There may be one or more instances of each box representing an actor

This set of base standards includes the CEN ISO/TS 17575-suite, ISO 17573, EN ISO 12855, CEN ISO/TS 13141 and CEN ISO/TS 12813. These standards have the characteristic of toolbox standards, specifying messages and data elements, which - if used – are to be used in the prescribed way. However, these base standards contain many optional features that may or may not be implemented by different Toll Chargers or Service Providers. Therefore, the base standards alone do not guarantee interoperability between the systems of different actors without further restrictions of the use of optional features of these base standards. This is the purpose of this profile standard – to restrict the choices from the above listed set of base standards.

This Technical Specification defines a number of Interoperable Application Profiles (IAP) for autonomous Electronic Fee Collection systems, according to the concept of "International Standardised Profiles (ISP)" as defined in ISO IEC/TR 10000-1. Each profile provides a coherent set of choices from among the options in the base standards. A profile thus may be used to determine a concrete set of requirements for EFC constituents. When multiple EFC systems are based on the same profile, the profile will serve as a common technical platform for EFC interoperability. Which profile should be chosen will depend on the needs of all participants in this EFC cluster and on the outcome of negotiations between them.

The profiles in this Technical Specification were created in order to meet the requirements of early adoptions of the general principles of autonomous interoperable EFC clusters, such as the upcoming European Electronic Toll Service. This Technical Specification specifies also a methodology to define a customised profile if none of the specified profiles are acceptable to all participants in an interoperable EFC cluster.

Each Toll Service Provider taking part in an EFC cluster should be aware that he needs to implement all the features of the chosen profile. Therefore, it will generally be in the best interest of the Service Providers to select the simplest profile that is still acceptable to all Toll Chargers.

Toll Chargers within the same EFC cluster, however, still have the choice to use any of these features or not.

1 Scope

This Technical Specification defines a set of interoperable application profiles suitable to be used defining the overall functionality of an interoperable EFC cluster using autonomous vehicle equipment. Doing so, it also defines a way of defining further profiles for future use.

The profiles cover a wide range from simple toll road systems up to very complex tolling principles and tariff rules. An EFC cluster shall select and use one of these profiles covering the needs of all participating Toll Chargers.

The scope is limited to those base standards providing data elements or messages to be used specifically when defining the data exchange for autonomous tolling principles. This covers ISO 17573 and the base standards CEN ISO/TS 17575 parts 1 to 4, CEN ISO/TS 12813, CEN ISO/TS 13141 and those parts of EN ISO 12855 specifying messages which are only relevant for autonomous systems.

Figure 3 provides a graphical illustration of the scope of this Interoperable Application Profile which is based on the ISP concept according to ISO IEC/TR 10000-1.

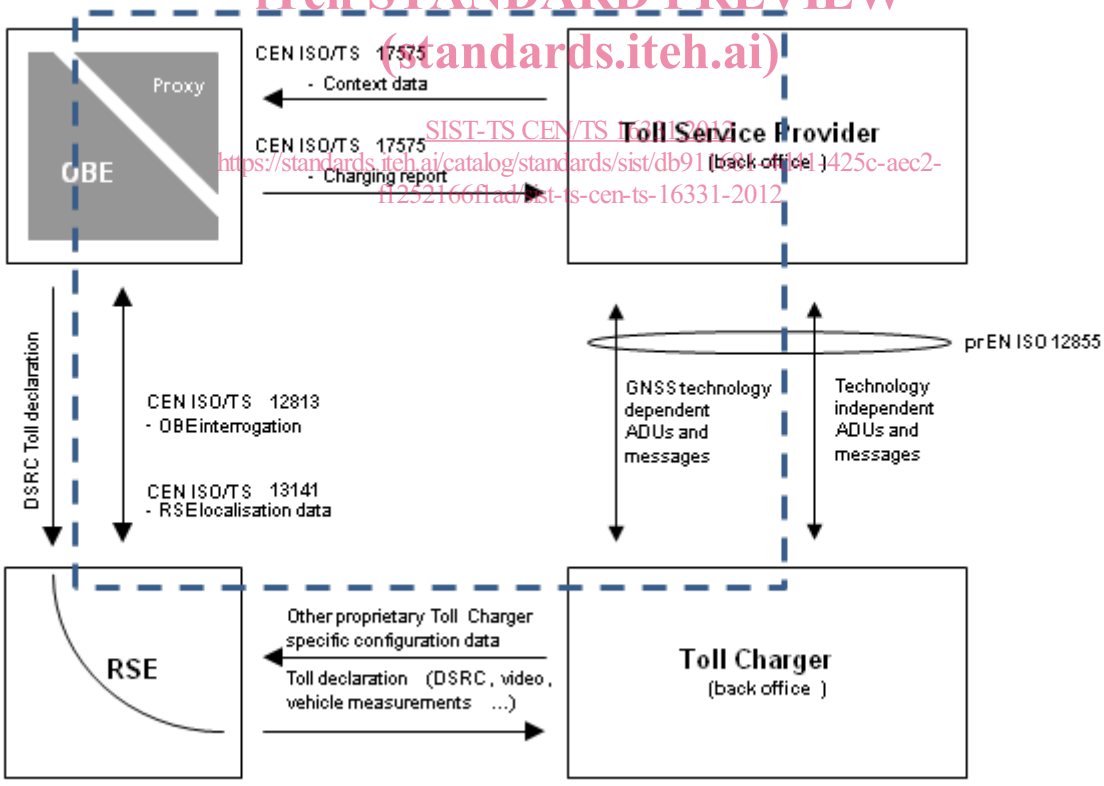

Figure 3 — The scope of this IAP covers the interfaces within the dotted lined box

For each specified profile, the conditional requirements resulting from the actual use of data elements being still optional according to this profile are specified in Annex A. A set of rules on how to re-use identifiers of a specific entity within the full chain of transactions is specified in Annex B and a protocol implementation conformance statement (PICS) proforma in Annex C.

Outside of the scope are:

— details on how to achieve security using the authenticator data elements of the base standards;

— how to operate the enforcement process;

— commercial aspects and the billing process;

— the handling of DSRC charging transactions;

— system monitoring and performance indicators;

— test standards;

— the initial configuration of the OBE.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 17573:2010, *Electronic fee collection - Systems architecture for vehicle-related tolling*

EN ISO 12855:2009, *Electronic fee collection – Information exchange between service provision and toll charging (ISO/DIS 12855:2009)*

CEN ISO/TS 12813:2009, *Electronic fee collection - Compliance check communication for autonomous systems (ISO/TS 12813:2009)*

CEN ISO/TS 13141:2010, *Electronic fee collection - Localisation augmentation communication for autonomous systems (ISO/TS 13141:2010)*

CEN ISO/TS 17575-1:2010, *Electronic fee collection - Application interface definition for autonomous systems - Part 1: Charging (ISO/TS 17575-1:2010)*

CEN ISO/TS 17575-2:2010, *Electronic fee collection - Application interface definition for autonomous systems - Part 2: Communication and connection to the lower layers (ISO/TS 17575-2:2010)*

CEN ISO/TS 17575-3:2011, *Electronic fee collection - Application interface definition for autonomous systems - Part 3: Context data (ISO/TS 17575-3:2011)*

CEN ISO/TS 17575-4:2011, *Electronic fee collection - Application interface definition for autonomous systems - Part 4: Roaming (ISO/TS 17575-4:2011)*

3 Terms and definitions

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

3.1
attribute
application information formed by one or by a sequence of data elements, used for implementation of a transaction

[SOURCE: EN ISO 14906:2011]

3.2
back end
generic name for the computing and communication facilities of the Service Provider and/or the Toll Charger

[SOURCE: CEN ISO/TS 17575-1:2010]

3.3
charge report
data structure transmitted from the Front End to the Back End to report road usage data and supplementary related information

[SOURCE: CEN ISO/TS 17575-1:2010]

3.4
context data
information defined by the responsible Toll Charger necessary to establish the toll due for circulating a vehicle on a particular Toll Domain and to conclude the toll transaction

[ISOURCE: SO 17573:2010]

3.5
context layout
group of attributes of the context data providing the geographic information of the EFC domain

3.6
EFC cluster
a group of toll schemes operating under a common agreement providing interoperability for vehicles equipped with an appropriate OBE and being contracted under a Toll Service Provider being part of the cluster

[SOURCE: CEN ISO/TS 17575-4:2011]

3.7
EFC domain
same as toll domain: area or part of a road network where a toll regime is applied

[SOURCE: ISO 17573:2010]

3.8
EFC regime
same as toll regime: set of rules, including enforcement rules, governing the collection of toll in a toll domain

[SOURCE: ISO 17573:2010]

3.9
front end
part(s) of the toll system where road usage data for an individual road user are collected, processed and delivered to the Back End

Note to entry The Front End comprises the on-board equipment and an optional proxy.

[SOURCE: CEN ISO/TS 17575-1:2010]

3.10
overview
attribute and group of data elements providing the information if an EFC context is relevant for a specific vehicle or not

3.11
relative time
point in time relative to a defined event e.g. the entrance of a vehicle into an EFC specific area in minutes and/or hours

3.12
roaming rules
set of attributes for Front Ends according to CEN ISO/TS 17575-4, defining the group of associated EFC contexts and their relationships; and/or for Back Ends according to EN ISO 12855, defining the relations for multi-context EFC domains

4 Abbreviations

For the purposes of this document, the following abbreviations apply throughout the document unless otherwise specified.

ADU	Application Data Unit
CCC	Compliance Check Communication
DSRC	Dedicated Short Range Communication
EFC	Electronic Fee collection
GDF	Geographic Data File
GNSS	Global Navigation Satellite System
IAP	Interoperable Application Profile
IUT	Implementation Under Test
ISP	International Standardised Profile
LAC	Localisation Augmentation Communication
OBE	On Board Equipment
OBU	On Board Unit
OSD[1]	Overlapping Sectioned Roads tolling and Distance based Area pricing
OSDT[1]	Overlapping Sectioned Roads tolling and Distance and Time based Area pricing
OSDTC[1]	Overlapping Sectioned Roads tolling, Distance and Time based Area and Cordon pricing
PICS	Protocol Implementation Conformance Statement
SD	Short form for the profile covering Sectioned Roads tolling and Distance based Area pricing
SR	Short form for the profile covering Sectioned Roads tolling
RSE	Road Side Equipment
SP	Service Provider (Toll Service Provider)
SUT	System Under Test
TC	Toll Charger
TSP	Toll Service Provider

[1] Short form for the profile covering.

5 General profile independent IAP requirements

5.1 The principle defining EFC cluster supported regime characteristics using profiles

This Technical Specification shall be used specifying the supported frame of the functional characteristics of an EFC cluster. This includes the supported basic tolling principles as well as details of the tariff models and the formats and details of toll declarations to be reported to the Toll Chargers. Each participating EFC regime shall be described staying within the EFC cluster specific functional frame.

The frame of the functional details supported in an EFC cluster is defined by including or excluding optional data elements of the base standards. These data elements represent parameters describing details of the rules to be observed by tolled vehicles, its users and the associated Service Providers. Hence, including or excluding a certain data element will result in allowing or not allowing a certain detail of the EFC regime characteristics.

Therefore, it is important, when defining this frame of defined characteristics within an EFC cluster, to include all the needs of all participating EFC regimes. This will form the basis for the associated EFC cluster specific profile.

To ease this selection process this Technical Specification provides a set of optional data elements of the base standards which are in different lists marked as allowed which means mandatory (m) or not allowed which means not applicable (n/a).

Each of these lists represents an interoperable application profile (IAP), also referred to as a profile (in short form) (see also Table 1, Table 2 and 7.2).

Stakeholders of an EFC cluster may agree to use one of these standardised IAPs or they agree to define an own profile using the same methodology as used within this Technical Specification.

From that follows that according to the variety of required tolling principles and other details a more or less complex profile may be selected as the EFC cluster profile.

5.2 Toll Charger requirements

5.2.1 General

Profiles according to this Technical Specification are constituted by a list of optional data elements of base standards which are re-classified as mandatory (m) or not applicable (n/a) for a specific profile (see Table 1).

To be compliant with any profile a Toll Chargers shall be compliant with all the base standards listed in Clause 2.

To be compliant with a specific profile a Toll Charger shall also follow the following rules:

— For all data elements where the Toll Charger is listed as the sender of a message the Toll Charger shall use only those data elements of the profile specific list which are marked as mandatory (m) and which are actually required for the toll domain specific needs (see the TC->TSP indication in the column "information flow" in Table 1).

NOTE 1 From that follows that Toll Chargers still have the choice using mandatory data elements or not.

— For all data elements where the Toll Charger is listed as the receiver of a message the Toll Charger shall be prepared to receive and process all data elements marked as mandatory and which could be not logically excluded (see the TC<-TSP indication in the column "information flow" in Table 1).

NOTE 2 A mandatory data element may be logically excluded if in other configuration settings under the control of the Toll Charger this data element was "deselected" e.g. in the `ChargeReportConfiguration`

If the actual use of profile conformant data elements causes conditional requirements then the Toll Charger shall comply with them. These conditional requirements are specified in individual clauses in Annex A and they are referenced in the data element list (see Table 1). Other optional data elements of the base standards which are not mentioned in the data element tables remain optional. Toll chargers shall be prepared to process these data elements as specified in the base standards.

5.2.2 Toll Charge Back End requirements

For data exchange with the central equipment of one or more Service Providers the Toll Charger shall provide a Back End interface compliant with EN ISO 12855 for the following ADUs:

— `efcContextDataADU`

— `tollDeclarationADU`

NOTE 1 Within the context of this IAP only EFC contexts according to the GNSS choice are specified.

NOTE 2 The use of other ADUs defined in EN ISO 12855 may be specified in other profile standards or documents.

To be compliant with a specific profile a Toll Charger shall use only those or a subset of those optional data elements of the `efcContextDataADU` which are specified in Table 1 in Clause 7 as being mandatory for this profile and shall also fulfil the conditional requirements referenced for each used data element in the same table.

In general optional data elements within the underlying ASN1 structure of the used data elements are remained. However, explicit restrictions on that specified within Table 1 or within the applicable conditional requirements specified in Annex A shall be observed. The Toll Charger shall use the `tollDeclarationADU` received from the Service Provider to initiate the billing process.

The Toll Charger shall use the `requestADU, ackADU` and the `retrieveTollDeclarationADU` as specified in EN ISO 12855.

5.3 Toll Charger RSE requirements

For data exchange with OBE for the purpose of compliance, check the Toll Charger shall provide RSE compliant with CEN ISO/TS 12813. The underlying communication stack shall comply with the CEN DSRC choice as specified in CEN ISO/TS 12813:2009, 5.5.

NOTE 1 The density and locations of CCC RSE are decided by the Toll Charger.

For data exchange with OBE for the purpose of localisation augmentation the Toll Charger shall provide RSE compliant with CEN ISO/TS 13141. The underlying communication stack shall comply with the CEN DSRC choice as specified in CEN ISO/TS 13141:2010, 5.5.

NOTE 2 The locations of LAC RSE are decided collectively by the Toll Charger and the Service Providers.

5.4 Service Provider requirements

5.4.1 General

As mentioned above profiles according to this Technical Specification are constituted by a list of optional data elements of base standards which are re-classified as mandatory (m) or not applicable (n/a) for a specific profile (see Table 1 and Table 2).

To be compliant with any profile a Service Provider shall be compliant with all the base standards listed in Clause 2.

To be compliant with a specific profile a Service Provider shall also follow the following rules: