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Entwurf

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DIN CEN ISO/TS 17575-3
(DIN SPEC 70662):2011-10

**Elektronische Gebührenerhebung –
Definition der Anwendungsschnittstelle für autonome Systeme –
Teil 3: Kontextdaten (ISO/DIS 17575-3:2013);
Englische Fassung prEN ISO 17575-3:2013**

Electronic fee collection –
Application interface definition for autonomous systems –
Part 3: Context data (ISO/DIS 17575-3:2013);
English version prEN ISO 17575-3:2013

Perception du télépéage –
Définition de l'interface d'application pour les systèmes autonomes –
Partie 3: Données du contexte (ISO/DIS 17575-3:2013);
Version anglaise prEN ISO 17575-3:2013

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Nationales Vorwort

Dieses Dokument (prEN ISO 17575-3:2013) wurde vom Technischen Komitee ISO/TC 204 „Intelligent Transport Systems“ in Zusammenarbeit mit dem Technischen Komitee CEN/TC 278 „Intelligente Verkehrssysteme“, dessen Sekretariat vom NEN (Niederlande) gehalten wird, erarbeitet.

Das zuständige deutsche Normungsgremium ist der Gemeinschaftsarbeitsausschuss NA 052-02-71 GA „Straßenverkehrstelematik“ des Normenausschusses Automobiltechnik (NAAutomobil).

Das Präsidium des DIN hat mit seinem Beschluss 1/2004 festgelegt, dass von dem in den Regeln der europäischen Normungsarbeit von CEN/CENELEC verankerten Grundsatz, wonach Europäische Normen in den drei offiziellen Sprachen Deutsch, Englisch und Französisch veröffentlicht werden, in begründeten Ausnahmefällen abgewichen und auf die deutsche Sprachfassung verzichtet werden kann.

Die Genehmigung dafür hat die DIN-Geschäftsleitung entsprechend ihren in Anlage 1 zu dem DIN-Rundschreiben A 5/2004 festgelegten Kriterien für die vorliegende Norm auf Antrag des NA 052 NAAutomobil als Ergebnis einer Einzelfallentscheidung erteilt, zumal bereits dieser Norm zugrunde liegende Papiere überwiegend in englischer Sprache auch von den deutschen Marktteilnehmern angewendet werden.

Die in diesem Teil der ISO 17575 definierten Daten werden verwendet, um Gebührenerhebungsberichte zu erstellen, die Informationen zur Straßennutzung durch ein Fahrzeug für bestimmte Zeitintervalle enthalten. Der Inhalt dieser Gebührenerhebungsberichte kann zwischen den Mautregimes schwanken. Ein Mautregime umfasst einen Satz von Regeln zur Gebührenerhebung, einschließlich des von der Gebührenerhebung betroffenen Netzes, der Erhebungsgrundsätze, der der Gebührenpflicht unterworfenen Fahrzeuge und einer Definition des erforderlichen Inhalts eines Gebührenerhebungsberichts.

Die in diesem Teil der ISO 17575 definierten Daten werden entsprechend der Definition in ISO 17575-2 unter Anwendung einer offenen Definition eines Kommunikations-Stacks ausgetauscht.

Die Definitionen in diesem Teil der ISO 17575 umfassen Folgendes:

- Berichtsdaten, d. h. Daten zur Übertragung von Daten zur Straßennutzung vom Front-End zum Back-End, einschließlich einer Antwort vom Back-End an das Front-End;
- Vertragsdaten, d. h. Daten zur Identifizierung vertraglich erforderlicher Entitäten;
- Straßennutzungsdaten, d. h. Daten zur Übermittlung des Umfangs der Straßennutzung;
- Rechnungsdaten zur Verwaltung eines Rechnungskontos.

Änderungen

Gegenüber DIN CEN ISO/TS 17575-3 (DIN SPEC 70662):2011-10 wurden folgende Änderungen vorgenommen:

- a) Überführung in eine DIN-EN-ISO-Norm;
- b) Adaption verschiedener Normenreferenzen auf die neueste Version;
- c) kleinere technische und editorische Verbesserungen, mit Rücksicht auf die Rückwärtskompatibilität;
- d) Einführung einer Protokoll-Versionsidentifizierung;
- e) Harmonisierung der Identifizierung von Mautinhalt zwischen allen 4 Teilen der ISO 17575;
- f) Nutzung einer zweiten Währungsalternative für die Tarife;
- g) Revision der Begriffe.

Nationaler Anhang NA (informativ)

Begriffe

Für die Anwendung dieses Dokuments gelten die folgenden Begriffe.

- 3.1
Gebietspreisbildung**
(en: area pricing)
Gebührenerhebungsprozess, basierend auf einer Straßennutzung innerhalb eines vorgegebenen Gebiets
- 3.2
Attribut**
(en: attribute)
adressierbares Datenpaket, welches entweder aus einem einzelnen Datenelement, oder einer strukturierten Sequenz von Datenelementen besteht
- 3.3
authentifizierendes Merkmal**
(en: authenticator)
Datenanhang oder kryptografische Transformation einer Dateneinheit, welche dem Datenempfänger erlaubt, die Integrität des Senders und/oder der Dateneinheit zu prüfen und gegen Fälschung zu schützen

[ISO 14906:2011, Definition 3.4]
- 3.4
Back End**
Rechner- oder Kommunikationseinheiten des Akteurs (z. B. Mauterheber oder Maut Dienstanbieter) zum Datenaustausch mit einem Front- oder Back End
- 3.5
Abbuchungsbericht**
(en: charge report)
Informationen zur Straßennutzung und -bezogene Informationen, welche vom Front-End generiert wurden
- 3.6
Abbuchungsobjekt**
(en: charge object)
jedes geografisches oder straßenbezogenes Objekt zur Nutzung von Abbuchungen
- 3.7
Grenzlinie**
(en: cordon)
Gebietsgrenzlinie
- 3.8
Grenzlinienpreisbildung**
(en: cordon pricing)
Abbuchungsprozess, basierend auf registrierten Überquerungen von Grenzlinien
- 3.9
Datenelement**
(en: data element)
kodierte Information, die aus weiteren Basiselementen bestehen könnte

3.10

Datengruppe

(en: data set)

logische Gruppe von Datenelementen, welche nach semantischen Relationen definiert sind

ANMERKUNG Die Datengruppe wird nur zum besseren Verständnis genutzt und ist vollkommen unabhängig von umgesetzten Implementierungslösungen.

3.11

Front End

Teile eines Mautsystems, mit dem Straßenbenutzungsdaten eines individuellen Straßenbenutzers gesammelt, verarbeitet und an die ‚Back-End‘-Einheit übermittelt werden

ANMERKUNG Das „Front-End“ umfasst die fahrzeugelektronische Ausrüstung sowie einen optionalen Vertreter (Proxy).

3.12

Layout

(en: layout)

technische Beschreibung zur Position eines Mautobjekts und dessen Grenzen

3.13

On-Board Einheit

(en: on-board equipment)

Ausrüstung innerhalb eines Fahrzeuges inklusive mobiler Endgeräte zum Austausch von Informationen mit externen Systemen

3.14

Vertreter

(en: proxy)

optionale Einheit des Front Ends, welches mit externen Einrichtungen kommuniziert und empfangene Daten in ein abgestimmtes Format verarbeitet und an das Back-End übermittelt

3.15

Straßenabschnittsgebühr

(en: road section charging)

Mautprinzip, bei der eine Gebühr fällig wird, wenn vordefinierte Straßenabschnitte benutzt werden

3.16

Maut

(en: toll)

Abgabe, Steuer, Gebühr oder Verpflichtung in Verbindung einer Fahrzeugbenutzung innerhalb einer Maut-domäne

ANMERKUNG Die Definition ist eine Generalisierung der klassischen Definition der Maut als Abgabe, Steuer oder Pflichtabgabe, um eine Grenze übertreten zu dürfen bzw. eine Straße oder Brücke benutzen zu können (usw.). Die Definition beinhaltet außerdem Pflichtgebühren wie Steuer.

3.17

Mautgebiet

(en: tolled area)

geografisches Gebiet, in dem Maut zur Nutzung von Fahrzeugen verlangt wird

3.18

Mautinhalt

(en: toll context)

logischer Blick auf ein Mautschema, welches aus Grundelementen von Attributen und Funktionen festgelegt ist und aus einem einzelnen Grundprinzip zur Maut besteht, sowie eine räumliche Verteilung des Gebührenobjektes und das einzelne Verhalten des relevanten Front-Ends charakterisiert

3.19**Maut Inhaltsdaten**

(en: toll context data)

Information, die vom verantwortlichen Mauterheber festgelegt wurde und notwendig ist, die Mautgebühr zur Nutzung eines Fahrzeugs auf einem bestimmten Mautinhalt einzuführen und die Mautübertragung abzuschließen

3.20**Mautdomain**

(en: toll domain)

Bereich oder Teil eines Straßennetzwerks, in der ein bestimmtes Mautregime angewendet wird

[Quelle: ISO 14906:2011, Definition 3.21]

3.21**Mautregime**

(en: toll regime)

Menge von Regeln inklusive Vollstreckungsregeln zur Regelung von Mauteinnahmen in einem Mautgebiet

3.22**Mautübersicht**

(en: toll scheme)

organisatorischer Blick auf ein Mautregime, welcher die Akteure sowie deren Beziehungen beinhaltet

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 17575-3 was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*, Subcommittee SC , and by Technical Committee CEN/TC 278, *Intelligent transport systems* in collaboration.

This second edition cancels and replaces the first edition (CEN/TS 17575-3:2011).

ISO 17575 consists of the following parts, under the general title *Electronic fee collection — Application interface definition for autonomous systems*:

- *Part 1: Charging,*
- *Part 2: Communication and connection to the lower layers,*
- *Part 3: Context data,*
- *Part 4: Roaming.*

This second edition (ISO 17575-3:xxx) of part 3 of ISO 17575 provides the following changes compared to the previous one:

- adaptation to new versions of other standards, especially ISO 14906;
- several minor technical and editorial improvements, with emphasis on backward compatibility with the first version of ISO 17575;
- conversion into a full International Standard;
- further changes:
 - introduction of protocol version identification;
 - harmonization of the identification of Toll Contexts amongst the four parts of this standard;
 - improvement of the possibility to use rounding rules;
 - enabling the use of a second alternative currency in tariffs;

- adaptation of the charge reporting configuration to changes in part 1 of ISO 17575;
- revision of the terms and definitions (clause 3).

Introduction

Autonomous systems

This part of ISO 17575 is part of a series of specifications defining the information exchange between the Front End and the Back End in Electronic Fee Collection (EFC) based on autonomous on-board equipment (OBE). EFC systems automatically collect charging data for the use of road infrastructure including motorway tolls, zone-based fees in urban areas, tolls for special infrastructure like bridges and tunnels, distance-based charging, and parking fees.

Autonomous OBE operates without relying on dedicated road-side infrastructure by employing wide-area technologies such as Global Navigation Satellite Systems (GNSS) and Cellular Communications Networks (CN). These EFC systems are referred to by a variety of names. Besides the terms autonomous systems and GNSS/CN systems, also the terms GPS/GSM systems and wide-area charging systems are in use.

Autonomous systems use satellite positioning, often combined with additional sensor technologies such as gyroscopes, odometers and accelerometers, to localize the vehicle and to find its position on a map containing the charged geographic objects, such as charged roads or charged areas. From the charged objects, the vehicle characteristics, the time of day and other data that are relevant for describing road use, the tariff and ultimately the road usage fee are determined.

Some of the strengths of the autonomous approach to electronic fee collection are its flexibility, allowing the implementation of almost all conceivable charging principles, and its independence from local infrastructure, thereby predisposing this technology towards interoperability across charging systems and countries. Interoperability can only be achieved with clearly defined interfaces, which is the aim and justification of ISO 17575.

Business architecture

This part of ISO 17575 complies with the business architecture defined in ISO 17573. According to this architecture, the Toll Charger is the provider of the road infrastructure and, hence, the recipient of the road usage charges. The Toll Charger is the actor associated with the Toll Charging role. See Figure 1.

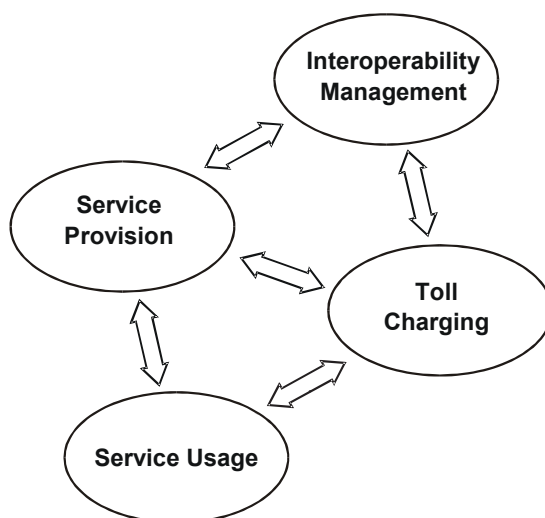


Figure 1 — The role based model underlying this International Standard

Service Providers issue OBE to the users of the road infrastructure. Service Providers are responsible for operating the OBE that will record the amount of road usage in all toll charging systems the vehicle passes through and for delivering the charging data to the individual Toll Chargers. In general, each Service Provider delivers charging data to several Toll Chargers, as well as each Toll Charger in general receives charging data from more than one Service Provider. Interoperability Management in Figure 1 comprises all specifications and activities that in common define and maintain a set of rules that govern the overall toll charging environment.

Technical architecture

The technical architecture of Figure 2 is independent of any particular practical realization. It reflects the fact that some processing functionalities can either be allocated to the OBE or to an associated off-board component (Proxy). An example of processing functionality that can be realized either on- or off-board is map-matching, where the vehicle locations in terms of measured coordinates from GNSS are associated to geographic objects on a map that either resides on- or off-board. Also tariffication can be done with OBE tariff tables and processing, or with an off-board component.

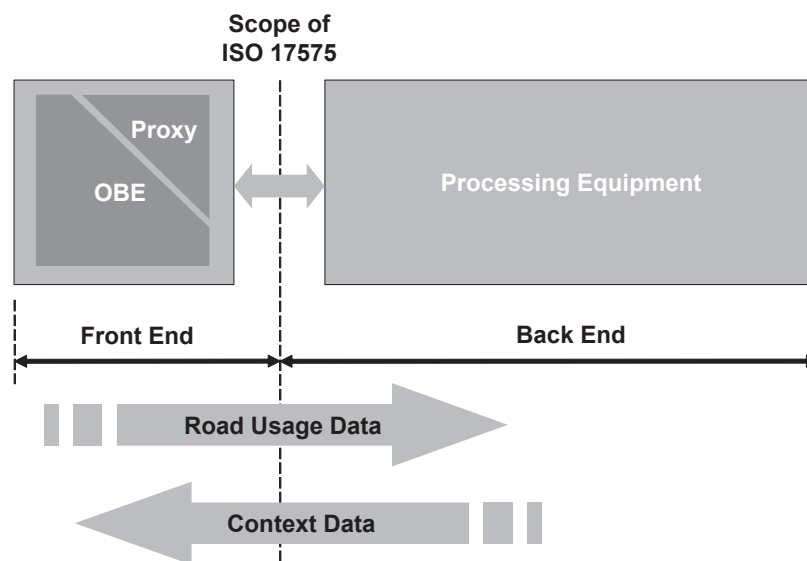


Figure 2 — Assumed technical architecture and interfaces

The combined functionality of OBE and Proxy is denoted as Front End. A Front End implementation where processing is predominately on OBE-side is known as a smart client (or intelligent client, fat client) or edge-heavy. A Front End where processing is mostly done off-board is denoted as thin-client or edge-light architecture. Many implementations between the “thin” and “thick” extremes are possible, as depicted by the gradual transition in the wedges in Figure 2. Both extremes of architectural choices have their merits and are one means where manufacturers compete with individual allocations of functionality between on-board and central resources.

Especially for thin client OBE, manufacturers might devise a wide variety of optimizations of the transfer of localization data between OBE and off-board components, where proprietary algorithms are used for data reduction and data compression. Standardization of this transfer is neither fully possible nor beneficial.

Location of the specification interface

In order to abstract from, and become independent of, these architectural implementation choices, the primary scope of ISO 17575 is the data exchange between Front End and Back End (see the corresponding dotted line in Figure 2). For every toll regime, the Back End will send context data, i.e. a description of the toll regime in terms of charged objects, charging rules and, if required, the tariff scheme to the Front End, and will receive usage data from the Front End.

It has to be noted also that the distribution of tasks and responsibilities between Service Provider and Toll Charger will vary individually. Depending on local legal situation, Toll Chargers will require “thinner” or “thicker” data, and might or might not leave certain data processing tasks to Service Providers. Hence, the data definitions in ISO 17575 may be useful on several interfaces.

ISO 17575 also provides for basic media-independent communication services that may be used for communication between Front End and Back End, which might be line-based or an air-link, and can also be used for the air-link between OBE and central communication server.

The parts of ISO 17575

Part 1: Charging, defines the attributes for the transfer of usage data from the Front End to the Back End. The required attributes will differ from one Toll Charger to another, hence, attributes for all requirements are offered, ranging from attributes for raw localization data, for map-matched geographic objects and for completely priced toll transactions.

Part 2: Communication and connection to lower layers, defines basic communication services for data transfer over the OBE air-link or between Front End and Back End.

Part 3: Context Data, defines the data to be used for a description of individual charging systems in terms of charged geographical objects and charging and reporting rules. For every Toll Charger's system, attributes as defined in Part 3 are used to transfer data to the Front End in order to instruct it which data to collect and report.

Part 4: Roaming, defines the functional details and data elements required to operate more than one EFC regime in parallel. The domains of these EFC regimes may or may not overlap. The charge rules of different overlapping EFC regimes can be linked, i.e. they may include rules that an area pricing scheme will not be charged if an overlapping toll road is used and already paid for.

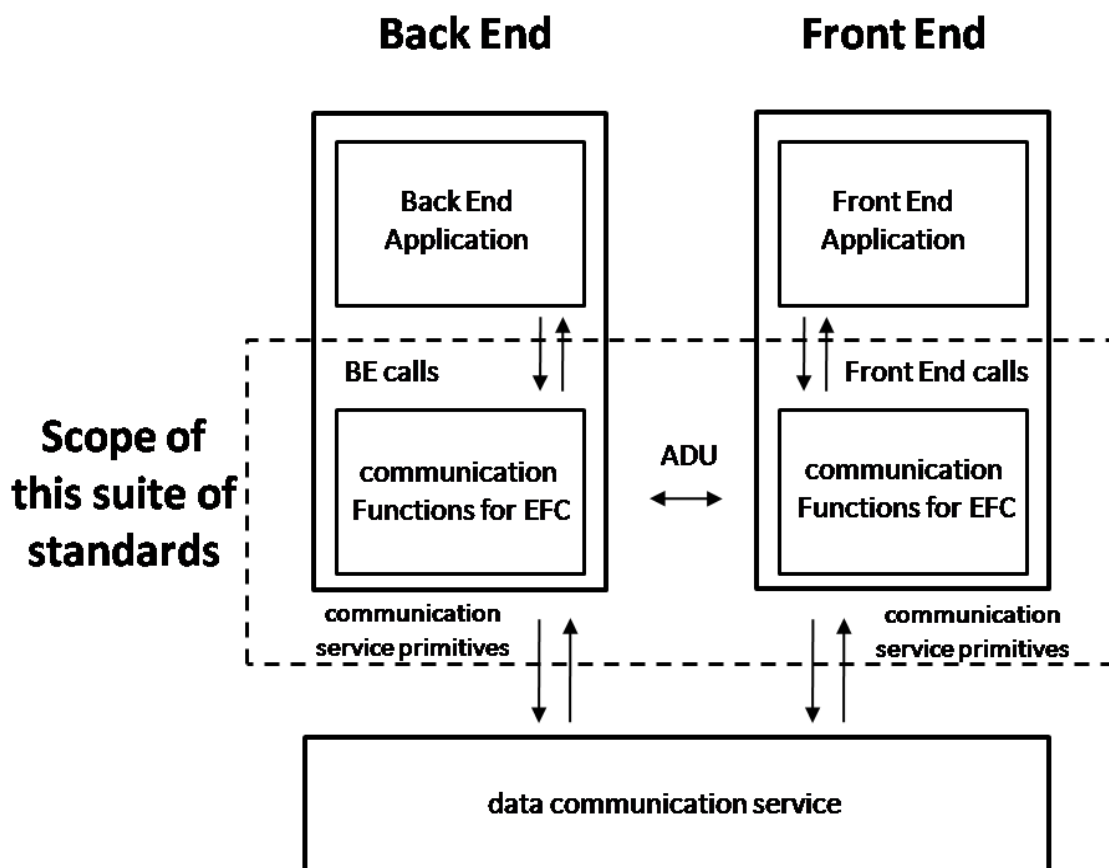


Figure 3 — Scope of ISO 17575

Application needs covered by ISO 17575

- The parts of ISO 17575 are compliant with the architecture defined in ISO 17573.
- The parts of ISO 17575 support charges for use of road sections (including bridges, tunnels, passes, etc.), passage of cordons (entry/exit), and use of infrastructure within an area (distance, time).
- The parts of ISO 17575 support fee collection based on units of distance or duration, and based on occurrence of events.
- The parts of ISO 17575 support modulation of fees by vehicle category, road category, time of usage, and contract type (e.g. exempt vehicles, special tariff vehicles, etc.)
- The parts of ISO 17575 support limiting of fees by a defined maximum per period of usage.
- The parts of ISO 17575 support fees with different legal status (e.g. public tax, private toll).
- The parts of ISO 17575 support differing requirements of different Toll Chargers, especially in terms of
 - geographic domain and context descriptions,
 - contents and frequency of charge reports,
 - feedback to the driver (e.g. green or red light), and
 - provision of additional detailed data on request, e.g. for settling of disputes.
- The parts of ISO 17575 support overlapping geographic toll domains.
- The parts of ISO 17575 support adaptations to changes in
 - tolled infrastructure,
 - tariffs, and
 - participating regimes.
- The parts of ISO 17575 support the provision of trust guarantees by the Service Provider to the Toll Charger for the data originated from the Front End.

Electronic fee collection — Application interface definition for autonomous systems — Part 3: Context data

1 Scope

This part of ISO 17575 defines the content, semantic and format of the data exchange between a Front End (OBE plus optional proxy) and the corresponding Back End in autonomous toll systems. This part of ISO 17575 comprises the definition of the data elements used to specify and describe the toll context details. Context data are transmitted from the Back End to the Front End.

In ISO 17575, context data is the description of the properties of a single instance of an EFC context. This single instance of an EFC context operates according to one of the basic tolling principles such as

- road section charging,
- area pricing according to travelled distance,
- area pricing according to the time,
- cordon pricing.

EFC context data comprise a set of rules for charging, including the description of the charged network, the charging principles, the liable vehicles and a definition of the required contents of the charge report. This set of rules is defined individually for each EFC context according to local needs.

This part of ISO 17575 contains the definitions of the above listed type of data.

Only a Front End configured with the context data necessary for the respective EFC context is able to be used for charging processes.

The following data definitions are in this part of ISO 17575:

- data providing toll context overview information;
- data providing tariff information (this includes definitions of required tariff determinants like vehicle parameters, time classes and others);
- data providing context layout information;
- data providing reporting rules information.

In case one EFC domain cannot be described with a single set of context data, several of these context data are used. ISO 17575-4 defines the parallel operation of more than one EFC context and how to handle interdependencies.

2 Normative references

The following referenced documents are indispensable for the application 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 612, *Road vehicles — Dimensions of motor vehicles and towed vehicles — Terms and definitions*

ISO 1176, *Road vehicles — Masses — Vocabulary and codes*

ISO 4217, *Codes for the representation of currencies and funds*

ISO/IEC 8824-1, *Information technology — Abstract Syntax Notation One (ASN.1): Specification of basic notation*

ISO/IEC 8825-2, *Information technology — ASN.1 encoding rules: Specification of Packed Encoding Rule (PER)*

ISO/TS 12813:2009, *Electronic fee collection — Compliance check communication for autonomous systems*

ISO 14906:2011, *Electronic fee collection — Application interface definition for dedicated short-range communication*

ISO 17573, *Electronic Fee Collection — Systems architecture for vehicle related transport services*

ISO 17575-1:2013, *Electronic fee collection — Application interface definition for autonomous systems — Part 1: Charging*

ISO 17575-2:2013, *Electronic fee collection — Application interface definition for autonomous systems — Part 2: Communication and connections to the lower layers*

EN 15509:2007, *Road transport and traffic telematics — Electronic fee collection — Interoperability application profile for DSRC*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 17573 and the following apply.

3.1 area pricing

charging process based on road usage occurring within a given area

3.2 attribute

addressable package of data consisting of a single data element or structured sequences of data elements

3.3 authenticator

data appended to, or a cryptographic transformation of, a data unit that allows a recipient of the data unit to prove the source and/or the integrity of the data unit and protect against forgery

[SOURCE: ISO 14906:2011, definition 3.4]

3.4 Back End

computing and communication facilities of an actor (e.g. a Toll Charger or a Toll Service Provider) exchanging data with a Front or Back End

3.5

charge report

information containing road usage and related information originated at the Front End

3.6

charge object

any geographic or road related object for the use of which a charge is applied

3.7

cordon

border line of an area

3.8

cordon pricing

charging process based on registering passages of a cordon

3.9

data element

coded information, which might itself consist of lower level information structures

3.10

data set

logical set of data elements selected by semantic relation

NOTE Data set is used only for better understanding and is fully independent from implementation solutions.

3.11

Front End

parts of the toll system where usage data for an individual user are collected, processed and delivered to the Back End

NOTE The Front End comprises the on-board equipment and an optional proxy.

3.12

layout

technical description of the location of tolled objects including their borders

3.13

on-board equipment

OBE

equipment located on-board a vehicle including nomadic devices with the function of exchanging information with external systems

3.14

proxy

optional part of a Front End that communicates with external equipment and processes the data received into an agreed format to be delivered to the Back End

3.15

road section charging

tolling principle where the fee is due if predefined sections of roads are used

3.16

toll

any charge, tax or duty levied in relation with using a vehicle in a toll domain

NOTE The definition is the generalization of the classic definition of a toll as a charge, a tax, or a duty for permission to pass a barrier or to proceed along a road, over a bridge, etc. The definition above also includes fees regarded as an (administrative) obligation, e.g. a tax or a duty.

3.17

tolled area

geographic area where a toll is charged for road usage

3.18

toll context

logical view as defined by attributes and functions of the basic elements of a toll scheme consisting of a single basic tolling principle, a spatial distribution of the charge objects and a single behaviour of the related front end

3.19

toll context data

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

3.20

toll domain

area or part of a road network where a toll regime is applied

[SOURCE: ISO 14906:2011, definition 3.21]

3.21

toll regime

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

3.23

toll scheme

organizational view of a toll regime, including the actors and their relationships

4 Abbreviated terms

For the purposes of this document, the following abbreviated terms apply.

ADU	Application data unit
ASN.1	Abstract Syntax Notation One (ISO/IEC 8824-1)
CCC	Compliance Check Communication, as defined by ISO/TS 12813:2009
CN	Cellular network
DST	Daylight saving time
EFC	Electronic Fee Collection (ISO 14906:2011); here used equivalently to the term toll in ISO 17573
GNSS	Global Navigation Satellite Systems
HOT	High Occupancy Tolling
ID	Identifier
OBE	On Board Equipment
PICS	Protocol Implementation Conformance Statements
UTC	Coordinated Universal Time
VAT	Value added tax

5 General concept and overview

To enable a Front End to operate autonomously in a toll domain in the expected manner, a particular set of data elements containing application data has to be available to the Front End. These data elements shall contain a description of the rules which apply in a toll domain. This includes information regarding tariffs, vehicle classes, description of the charge objects and others.

The data elements shall be made available to the Front End using the communication services described in ISO 17575-2.

For the purpose of data transfer an application data unit (ADU) is defined which comprises a header (mainly containing identification and data management information) and a data body (containing the application data elements itself).

The ADU header allows for identification of the data originator and the data sender. Furthermore it contains information about the EFC context to which the application data belong. Finally the ADU header carries a sequence number and an optional authenticator.

The data elements containing the EFC context description shall be dedicated to one single EFC context. To support the use of the Front End in multiple EFC contexts, the Front End may have the capability to manage multiple sets of data elements (one per EFC context) (see also Figure 4). Details regarding these “roaming” procedures and the normative requirements are defined in ISO 17575-4.

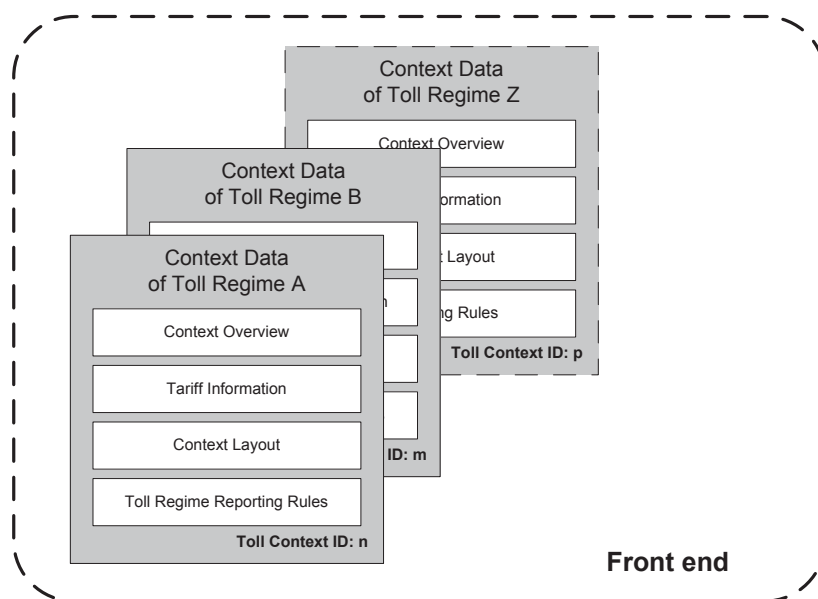


Figure 4 — Logical structure of toll context descriptions in a Front End

NOTE There may be a maximum number of toll regimes a Front End can manage. This number may depend on the memory size, the complexity of the toll regime and the envisaged use of the Front End. Front Ends may also be designed in a way to support the context description for one particular toll regime only. Other Front End designs may support context descriptions for more than one toll regime.

Context data are structured into logical data sets (refer to clause 8.2). Figure 5 gives an overview of these data sets and the type of information belonging to each data set.

Each data set comprises one or more EFC attributes. EFC attributes contain the application data. They are defined in clause 8.

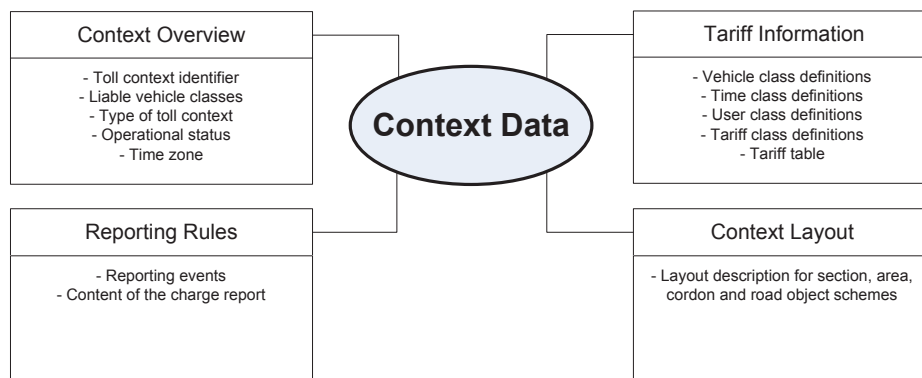


Figure 5 — Context data overview

The organization of the memory and the physical structure of the data within a Front End are outside the scope of this part of ISO 17575.

In this International standard the requirements with respect to procedures and data elements are presented in clauses 6, 7 and 8.

The normative Annex A contains the data type specification using ASN.1 notation.

The templates protocol implementation conformity to specification declarations are provided in Annex B.

The informative Annexes C and D contain further information and descriptions which may support the understanding and the implementation of the rules specified in this International Standard.

The informative Annex E provides information how this International Standard can be used in EETS environment and how the requirements that are specified in the EU-Decision 2009/750 are addressed by this standard.

6 Procedural requirements and encoding rules

6.1 Communication services

For the purpose of transmitting ADUs from the Back End to the Front End, the communication services defined in ISO 17575-2 shall be used.

6.2 Version and validity handling

6.2.1 Protocol versioning

The Back End shall provide with each submission of toll context data to the Front End the version of the protocol that is used by the Back End.

The protocol version information shall be part of the ADU header if the message. The specification of the protocol version information is provided in clause 7.2 and in Annex A.2.

If the receiving Front End does not support the protocol version the Back End is requesting it shall provide a negative response to the Back End.

NOTE The first version of this specification (CEN ISO TS 17575-3:2011) does not support protocol version information.

6.2.2 Context data versioning

Each EFC attribute includes an optional data element containing version and validity information. The data type of this data element shall always be **VersionAndValidity**. This data type shall comprise two data elements:

- **version** and
- **validFrom**.

The data element **version** shall give the version number of the respective EFC attribute. The data type shall be **VersionId** defined in ISO 17575-1. The version number shall always be used in an increasing order.

NOTE 1 This concept enables the Front End to autonomously detect missing versions of context data. This may be used to initiate an action to update the respective information.

The data element **validFrom** shall give the start date and time of the validity of the respective EFC attribute. The data type shall be **DateAndTime** as defined in ISO 14906.

The information regarding version and validity of EFC attributes enables the Front End to autonomously notice the existence of new updated context data in the Back End.

NOTE 2 Once the start date and time of a context data is reached, previous versions (having a version number lower than the current one) become obsolete. The Front End may decide - depending on local settings - to initiate an action to activate the valid context data and deactivate (and delete) the previous used version(s).

The given version and validity information are exclusively valid for the EFC attribute it belongs to.

NOTE 3 This concept allows the efficient use of different versions for different types of context data. E.g. the tariff table version may be managed independently from the one valid for context layout and reporting rules. This approach reduces the amount of data to be updated.

NOTE 4 The update process itself is outside the scope of this part of ISO 17575.

The optional data element **tollContextVersion** shall be used for the version identification for the entire toll context description. This data element is a component of the data type **Iso17575-3AduBody**. The data type shall be **Int1**.

NOTE 5 If and how such context version identification is composed using the version information of the underlying attributes and data elements (i.e. vehicle class definitions, layout description, charge reporting events, charge report configuration, tariff definitions) will depend on the particular operational requirements and implementation solution.

NOTE 6 One potential use of such context version identification is in relation to compliance checking and the related data exchange (CCC). The relevant standard CEN ISO TS 12813 specifies a context version identifier (also of type **Int1**) that may be provided from the front-end to enforcement facilities. Based on such data a simple check is possible to identify front-ends in enforcement processes which use an outdated version of the toll context description.

6.3 Encoding rules

The data types and associated coding related to the data elements described in Clauses 7 and 8 are defined using the Abstract Syntax Notation One (ASN.1) technique according to ISO/IEC 8824-1 (Annex A).

The packed encoding rules according to ISO/IEC 8825-2 shall be applied.

Octet alignment shall be used.

The distinguished encoding rules shall not apply.

7 Application data units

7.1 Application data unit structure

For the purpose of data transfer and identification the information content shall be structured into application data units (ADU).

Each ADU shall consist of

- an ADU header and
- an ADU body.



Figure 6 — Structure of an ISO 17575-3 ADU

7.2 Application data unit header

The ADU header shall provide management information that apply in relation to the information provided in the ADU body. The Front End may need this information for internal processes of application data management, storage and processing.

The information provided in the ADU header is valid for the entire set of context data provided in the ADU header.

The ADU header shall consist of the data fields (Figure 7)

- protocol version identifier;
- information sender identifier;
- information originator identifier;
- toll charger identifier;
- context identifier;
- ADU sequence number;
- message date;
- ADU authenticator field (optional).

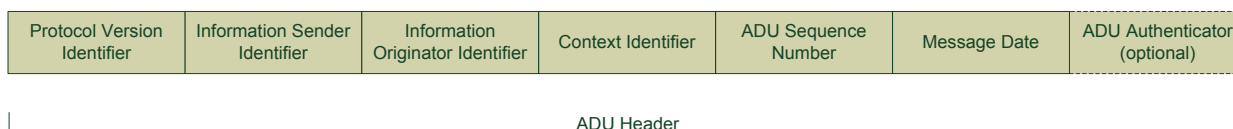


Figure 7 — Structure of the ADU header

The semantics for the data elements of the ADU header shall be according to Table 1. The data types are specified in Annex A.

Table 1 — Data elements of the ADU Header

Data element	Data type (informative)	Definition of semantic	Remarks
protocolVersion	UTF8String	Identifier of the version of the ASN.1 data specification (version of this standard) that is used in the application data units	e.g. "2.0" (refer also to clause 6.2.1)
informationSender	Provider	Unique identifier of the entity which has sent the data provided in the ADU body	e.g. Transport Service Provider, Toll Charger or Service Provider
informationOriginator	Provider	Unique identifier of the entity which has created the data provided in the ADU body	e.g. Transport Service Provider, Toll Charger or Service Provider
tollCharger	Provider	Unique identifier of the entity which acts as toll charger of the toll regime	Consist of country code and unique number within country
contextId	ContextId	Identifier for the individual toll context the data in the ADU body are applicable to	Uniqueness to be guaranteed by the Toll Charger within its realm (see also ISO 17575-1 clause 6.5.3)
aduSequenceNumber	Int4	Sequence number of the respective ADU	Shall be used in increasing order. In case of overflow, the sequence number shall restart at 0.
messageDate	GeneralizedTime	Date and time when the message was generated by the informationOriginator	Can be used for message security purposes, e.g. for the generation of the authenticator
aduAuthenticator	Bit String	Message Authenticator	Optional

7.3 Application data unit body

The ADU body shall contain one or more EFC attributes describing the EFC context. One ADU body shall contain EFC attributes belonging to one single EFC context only.

NOTE Very complex EFC contexts (e.g. containing different types of toll schemes like a cordon pricing and a section pricing) may be split into two EFC context descriptions. Interdependencies between these multiple layout descriptions are specified in ISO 17575-4.

The EFC context for which the data in the ADU body provide detailed description is identified by information given in data element `contextId` in the ADU header.

EXAMPLE 1 The ADU body contains the tariff table for the Barcelona congestion charging scheme.

EXAMPLE 2 The ADU body contains the geographic description of the road network of the truck tolling schemes applicable on highways in Hungary.

EXAMPLE 3 The ADU body contains the reporting rules applicable in the nationwide all-road charging scheme in Denmark.

EFC attributes and sections descriptions are defined in clause 8.

The ADU body also contains the optional data element `tollContextVersion`. This data element can be used to specify the version of the entire toll context description (refer also to clause 6.2.2).

8 EFC Attributes

8.1 Rules with respect to support of context data

Context data available in the Front End shall contain all information required to ensure a minimum level of functionality to either participate in the services of this toll regime or to unambiguously identify the toll regime as not valid (for the specific user, vehicle, moment in time...).

Each attribute being part of the context data shall be allocated to one single EFC context.

8.2 Attributes and data sets

Each EFC context shall be described using one or more EFC attributes. EFC attributes shall contain all necessary information to enable proper functioning of the Front End in the respective EFC context.

To improve readability of this part of ISO 17575 toll context description respectively attributes have been logically structured into data sets.

The following data sets are used:

- Regime Overview,
- Tariff Information,
- Context Layout,
- Reporting Rules.

NOTE Logical data sets are fully independent from the physical data structure in a Front End. The physical structure is implementation dependent and outside the scope of this part of ISO 17575.

8.3 EFC attributes data catalogue

8.3.1 General

The following EFC attributes or a subset here of shall be available to the Front End (Table 2).

Table 2 — List of EFC attributes

EFC Attribute	Data set	Refer to
TollContextOverview	Context Overview	clause 8.3.2
TariffTable	Tariff Information	clause 8.3.3.2
CurrencyConversionTable		clause 8.3.3.2.3
TariffClassDefinition		clause 8.3.3.2.3
LocalVehicleClassDefinition		clause 0
TimeClassDefinition		clause 8.3.3.4
UserClassDefinition		clause 8.3.3.5
TollContextLayout	Context Layout	clause 8.3.4
ChargeReportingEvents	Reporting Rules	clause 8.3.5.1
ChargeReportConfiguration		clause 8.3.5.2
TollContextVersion	Version Information	clause 6.2.2

In the following clauses, EFC attributes and data elements are specified in terms of:

- the names of the data elements forming the EFC attributes,
- the content and semantic definition of the EFC attributes and data elements,
- informative remarks, including references to other standards.

The specification of the corresponding data types in ASN.1 is provided in the normative Annex A.

8.3.2 Data set “Context Overview”

Toll context overview information shall be represented by one single EFC attribute **TollContextOverview**.

The attribute **TollContextOverview** shall contain information about toll context identification, type of the toll scheme (e.g. section based tolling, area pricing, cordon pricing), time zone information and information regarding the operational status of the toll context.

The main purpose of the EFC attribute **TollContextOverview** is to give the Front End a minimum amount of basic information regarding a toll scheme. Based on these overview data the Front End may or may not require more information.

EXAMPLE Based on the information in data element `tollContextBoundingBoxes` a Front End dedicated to a passenger car may notice that it is cruising in a toll domain. But due to the information in the data element `operationalStatus` it may realize that this toll regime is currently inactive. In this case the Front End may not require additional data (like context layout or tariff table) of this respective toll scheme.

Structure and data elements of the EFC attribute **TollContextOverview** are given in Table 3 and defined in Annex A.

Table 3 — EFC attribute TollContextOverview (informative)

EFC Attribute	Data element	Data Type	Remark
TollContextOverview	tollCharger	Provider	
	tollSchemeName	UTF8String	optional
	tollSchemeType	TollSchemeType	
	operationalStatus	OperationalStatus	
	timeZone	INTEGER (-720..720)	
	dSTOffset	INTEGER (-120..120)	optional
	tollContextBoundingBoxes	SEQUENCE OF SphericalBox	optional
	TollContextOverviewVersion	VersionAndValidity	
	TollContextOverviewAuthenticator	MessageAuthenticator	Optional

The data element **tollCharger** shall identify the toll charger which operates the toll scheme for which the context description is valid. The data type shall be **Provider** as specified in ISO 14906.

The data element **tollSchemeName** shall contain a designation for the toll scheme. The data element shall be optional. The data type shall be **UTF8String**.

NOTE This data element may be used to display a well known "brand name" of the toll scheme in the OBE (e.g. "LKW Maut", "Go Maut" or "TIS-PL").

The data element **tollSchemeType** shall contain information regarding the type of the toll scheme (road section pricing, distance based area pricing, time based area pricing, cordon pricing).

The data element **operationalStatus** shall contain information regarding the period of operation of the toll scheme. This information shall be given by defining date and time when the toll regime starts or has started operation (in data element **startsOperationAt**) and optionally by defining date and time when the toll regime will stop operation (in data element **stopsOperationAt**). Both data elements **startsOperationAt** and **stopsOperationAt** shall be of data type **DateAndTime** defined in ISO 14906:2011.

The data element **timeZone** shall give the time zone applicable for the toll scheme in relation to UTC. The data type is **INTEGER(-720..720)**. The value shall be given in minutes in relation to UTC (-720 ... +720 minutes). In case one single toll domain is located on more than one time zone, this toll domain shall be split into two separate toll contexts and have two context descriptions.

All absolute time information used in EFC attributes and data elements defined in this part of ISO 17575 (especially in the time class definitions) shall be given in local real time. In case daylight-saving time applies the Front End shall be capable of re-calculating time information according to the applicable legal rules.

To provide supporting information with respect to daylight saving time, the optional data element **dSTOffset** shall be used to specify the amount of minutes the daylight saving time offsets compared to the standard local time. The data type shall be **INTEGER(-120..120)**. Positive values shall be used in case the daylight saving time is "ahead" of standard local time. Negative values shall be used in case the daylight saving time is "behind" the standard local time.

EXAMPLE1 In case the standard local time is 12:00h and dSTOffset = 60, the resulting applicable local time during DST is 13:00h.

EXAMPLE2 In case the standard local time is 12:00h and the dSTOffset = -45, the resulting applicable local time during DST is 11:15h.

NOTE The time and date from and till DST is effective is not specified in this standard. Particular rules that are compatible to the legal ground are available in several underlying IT systems and frameworks.

The data element **tollContextBoundingBoxes** shall contain a list of spherical rectangles which enclose the geographic area of the toll context. Each list entry shall be of data type **SphericalBox**. The data type **SphericalBox** shall contain the description of a spherical rectangle by defining the edges of the rectangle in latitude and longitude. The data element **SphericalBox** shall contain the data elements **southernLatitude**, **northernLatitude**, **westernLongitude** and **easternLongitude**. The data elements in the data type **SphericalBox** shall be used as follows:

- data element **southernLatitude** shall contain the lower (southernmost) latitude value (data type **Latitude**),
- data element **northernLatitude** shall contain the larger (northernmost) latitude value (data type **Latitude**),
- data element **westernLongitude** shall contain the lower (westernmost) longitude value (data type **Longitude**) and
- data element **easternLongitude** shall contain the larger (easternmost) longitude value (data type **Longitude**).

The data element **TollContextOverviewVersion** shall contain version and validity information for the EFC attribute **TollContextOverview**. The data type shall be **VersionAndValidity**. For details refer to clause 6.2.

The data element **TollContextOverviewAuthenticator** shall contain a message authenticator valid for the EFC attribute **TollContextOverview**. The data type shall be **MessageAuthenticator** defined in ISO 17575-1:2013. The data element **TollContextOverviewAuthenticator** shall be optional.

8.3.3 Data group “Tariff Information”

8.3.3.1 Concept and overview

The EFC attributes in the data set Tariff Information shall contain all necessary information regarding

- tariff table
- tariff classes and
- locally applicable definitions for vehicle classes, time classes and user classes.

All these information is toll regime specific.

The data set shall comprise the EFC attributes:

- **TariffTable;**
- **CurrencyConversionTable;**
- **TariffClassDefinition;**
- **LocalVehicleClassDefinition.**

- `TimeClassDefinition`
- `UserClassDefinition`

The following clauses give the descriptions and definitions for these EFC attributes.

The fee calculation algorithm is specified in clause 8.3.3.6.

8.3.3.2 Tariff table

Each EFC context description contains exactly one tariff table. The tariff table comprises the following information:

- For each tariff class:
 - a unique tariff class identifier,
 - the definition of the charge unit,
 - the rounding rule that applies for the charged units used (optional),
 - a basic fee per charge unit,
 - the rounding rule that applies for the fee calculated (optional),
 - the VAT amount per charge unit (optional),
 - the rounding rule that applies for the vat calculated (optional),
 - an interval scale parameter (optional),
 - an offset fee (optional)
 - a minimum fee (optional),
 - a threshold fee (optional),
 - a maximum fee (optional) and,
 - an alternative currency for this tariff class (optional)
- version and validity information
- authenticator (optional).

The tariff table provides all tariff data to the Front End which are required to calculate the Fee which has to be paid by a user under given and defined conditions (vehicle class, time class, ...).

8.3.3.2.1 EFC attribute `TariffTable`

The tariff table shall be presented in the EFC attribute `TariffTable`.

Structure and data elements of the EFC attribute `TariffTable` are given in Table 4 and defined in Annex A.

Table 4 — EFC attribute `TariffTable` (informative)

EFC Attribute	Data element	Data Type	Remark
TariffTable	<code>tariffs</code>	SEQUENCE OF <code>Tariff</code>	
	<code>standardCurrency</code>	<code>PayUnit</code>	
	<code>tariffTableVersion</code>	<code>VersionAndValidity</code>	
	<code>tariffTableAuthenticator</code>	<code>MessageAuthenticator</code>	optional

The data element `tariffs` shall contain a list of tariff related data for each tariff class. Each of the list entries shall be of data type `Tariff`. This data type is described in clause 8.3.3.2.2.

The data element `standardCurrency` shall be used to determine the currency that is used in the respective Toll Domain. This currency shall be applicable for all data containing any sort of fee information in the tariffs (refer to clause 8.3.3.2.2) which are `basicFeePerChargeUnit`, `offsetFee`, `minFee`, and `thresholdFee` and `maxFee`. The data type shall be `PayUnit` as specified in and imported from EN ISO 14906:2011.

In cases in which more than one currency is allowed or required in one toll domain (e.g. for particular user groups or because of legal requirements) the alternative currencies are specified in the respective tariff refer also to clause 8.3.3.2.2).

The data element `tariffTableVersion` shall contain version and validity information for the EFC attribute `TariffTable`. The data type shall be `VersionAndValidity`. For details refer to clause 6.2.

The data element `tariffTableAuthenticator` shall contain a message authenticator valid for the EFC attribute `TariffTableDefinition`. The data type shall be `MessageAuthenticator` defined in ISO 17575-1. The data element `tariffTableAuthenticator` shall be optional.

8.3.3.2.2 Data type `Tariff`

The data type `Tariff` shall provide the following information per tariff class:

- a tariff class identifier (to unambiguously identify a tariff class within the toll context description);
- the charge unit (e.g. 100 m);
- optional rounding rule for the calculation of the charge units used (e.g. always rounding up);
- basic fee per charge unit (e.g. 0,03 EUR);
- optional rounding rules for the calculated fee (e.g. always rounding down);
- optional VAT amount (e.g. 20,3%);
- optional rounding rules for the calculated VAT (e.g. always using accounting rounding rules);
- optional interval scale parameter;
- optional offset fee;
- optional minimum fee;

- optional threshold fee;
- optional maximum fee; and
- optional alternative currency that is valid for this particular tariff class.

Structure and data elements of the data type `Tariff` are given in Table 5 and defined in Annex A.

Table 5 — Data type `Tariff` (informative)

Data type	Data element	Data type	Remark
Tariff	<code>tariffClass</code>	<code>TariffClassId</code>	
	<code>chargeUnit</code>	<code>ChargeUnit</code>	
	<code>roundingRuleForChargeUnitsUsed</code>	<code>RoundingRule</code>	optional
	<code>basicFeePerChargeUnit</code>	<code>Int4</code>	
	<code>roundingRuleForFee</code>	<code>RoundingRule</code>	optional
	<code>vat</code>	<code>Int4</code>	optional
	<code>roundingRuleForVAT</code>	<code>RoundingRule</code>	optional
	<code>intervalScaleParameter</code>	<code>IntervalScaleParameter</code>	optional
	<code>offsetFee</code>	<code>Int4</code>	optional
	<code>minFee</code>	<code>Int4</code>	optional
	<code>thresholdFee</code>	<code>Int4</code>	optional
	<code>maxFee</code>	<code>MaxFee</code>	optional
	<code>alternativeCurrency</code>	<code>Currency</code>	optional

The data element `tariffClass` shall identify the tariff class. The data type shall be `TariffClassId`. This data type is defined as `Int4`. The applicable tariff class is defined in attribute `tariffClassDefinition`, which is defined in clause 8.3.3.2.3.

Data element `chargeUnit` shall contain the charge unit valid for the toll regime. It contains the smallest interval of time period, distance or number of events which is of relevance for the fee calculation. A charge unit shall have one of the following natures

- a distance (e.g. 100 m or 1 km) or
- a time period (e.g. 10 min, one hour or 7 hours) or
- a number of event occurred (e.g. one passage).

The use of charge units depend on the type of the charging scheme. The following combinations of charge unit type and toll regime type shall be possible:

- distance (e.g. meter, km) shall only be used in section or area pricing schemes,
- time (e.g. seconds, minutes, hours) shall only be used in area pricing schemes,
- event (number of passages) shall only be used in cordon or section pricing schemes

EXAMPLE 1 A section pricing scheme may use as charge unit 1 km, as the fee depends on the length of the used sections. In this example the fee increases every 1 km.

EXAMPLE 2 An area pricing scheme may use as charge unit 1 hour, as the fee depends on the duration of stay in the defined area. In this example the fee increases every hour.

EXAMPLE 3 A cordon pricing scheme may use as a charge unit 1 event, as the fee depends on the number of passages of the cordon. In this example the fee increases with every single event.

NOTE 1 In time based pricing schemes the charge unit may also be used to define the smallest possible time periods to be used in the fee calculation.

EXAMPLE 4 A time based pricing scheme with a charge unit value of 7 hours may be defined. In case the basic fee is defined by 5 GBP a stay in the charging area of less than seven hours would in any case result in a Fee of 5 GBP.

The data element **chargeUnit** shall be of data type **chargeUnit** which is a **CHOICE** type and has the type **distance**, **time** or **event**. The data type of the data element **distance** shall be **Distance** defined in ISO 17575-1. The data type of data element **time** shall be **Duration** which is defined in ISO 17575-1. The data type of the data element **event** shall be **Int1**.

The optional data element **roundingRuleForChargeUnitsUsed** shall be used to specify if and how rounding of distance driven or time in the toll liable network shall applied when determining the charge units used. The data type shall be **RoundingRules**. This data type is specified as an **ENUMERATED**. The following values are defined:

- **no** (0) - no rounding is applied,
- **up** (1) - always rounding up to the next full larger value of the charge unit specified in **chargeUnit**,
- **down** (2) - always rounding down to the next full lower value of the charge unit specified in **chargeUnit**,
- **accounting** (3) - always rounding according to methods used in accounting (e.g. as defined in DIN 1333)

EXAMPLE5 Charge units are specified with 200 m (section based pricing). The vehicle has used the toll liable road network for 750 meters. A rounding rule is set up to 1 = rounding up. As a result of the number of charge units used is 4.

EXAMPLE6 Charge units are specified with 4 hours (area based pricing). The vehicle has used the toll liable area for 5:56 h. A rounding rule is set up to 2 = rounding down. As a result of the number of charge units used is 1.

The data element **basicFeePerChargeUnit** shall contain the basic fee per charge unit. The data type shall be **Int4**. The value shall be given in the currency and unit as defined in the data element **standardCurrency** in the data element **tariffTable**. The value in the data element **basicFeePerChargeUnit** shall be given excluding VAT.

EXAMPLE 7 A **basicFeePerChargeUnit** value of 175, **currency** value of "EUR" and a currency unit of "minor units of 1000:1" (refer to EN ISO 14906) is specified. The resulting fee is 0,175 EUR = 17,5 Cent.

The optional data element **roundingRuleForFee** shall be used to specify if and how rounding of resulting toll fee shall applied when calculating the fee per used charge object (refer also to clause 8.3.3.6). The data type shall be **RoundingRules**. This data type is specified as an **ENUMERATED**. The following values are defined:

- **no** (0) - no rounding is applied,

- **up** (1) - always rounding up to the next larger value of the currencies minor unit,
- **down** (2) - always rounding down to the next lower value of the currencies minor unit,
- **accounting** (3) - always rounding according to methods used in accounting (e.g. as defined in DIN 1333)

The optional data element **vat** shall contain the VAT per charge unit. The data type shall be **int4**. The value shall be given in 0,01 %.

The optional data element **roundingRuleForVat** shall be used to specify if and how rounding of the resulting VAT for the toll fee shall applied when calculating the VAT per used charge object (refer also to clause 8.3.3.6). The data type shall be **RoundingRules**. This data type is specified as an **ENUMERATED**. The following values are defined:

- **no** (0) - no rounding is applied,
- **up** (1) - always rounding up to the next larger value of the currencies minor unit,
- **down** (2) - always rounding down to the next lower value of the currencies minor unit,
- **accounting** (3) - always rounding according to methods used in accounting (e.g. as defined in DIN 1333)

The optional data element **intervalScaleParameter** shall contain a list of additional parameters to adapt the basic fee depending on the parameters maximum laden weight of a vehicle and the length of the vehicle. These parameters shall contain offset values (data element **zeroOffset**), resolution data (data element **resolution**) and maximum values (data element **max**).

NOTE 2 Maximum laden weight of vehicles as interval scale parameters are currently in use in the Swiss LSVA toll scheme. The maximum length of a vehicle may be useful e.g. for payment for use of ferries.

The optional data element **offsetFee** shall be use to specify an offset value which should be added to the calculated fee (refer also to clause 8.3.3.6). The data type shall be **int4**. The value shall be given in the currency and currency units that are specified by the data element **standardCurrency** in the data element **tariffTable**.

The optional data element **minFee** shall be use to specify a minimum fee. This minimum fee may be lower than the fee which would apply according to the real usage of the charged network. The data type shall be **int4**. The value shall be given in the currency and currency units that are specified by the data element **standardCurrency** in the data element **tariffTable**.

EXAMPLE 6 A minimum fee of e.g. 1,00 EUR may apply in cases where only a short section of an section pricing scheme has been used by a vehicle would lead to a fee of only 0,10 EUR (e.g. 1 km x 0,10 EUR/km = 0,10 EUR).

The optional data element **thresholdFee** shall be used to specify a threshold fee. In case the fee which results from the real usage of the charged network is lower than the threshold value no fee shall apply. The data type shall be **int4**. The value shall be given in the currency and currency units that are specified by the data element **standardCurrency** in the data element **tariffTable**.

EXAMPLE 7 A vehicle uses a time based area pricing scheme for 10 minutes. The fee valid for the applicable tariff class is specified by 0,02 EUR per minute. The threshold fee is specified by 0,30 EUR. As the calculated fee does not reach the threshold value the resulting fee is 0,00 EUR.

The optional data element **maxFee** shall contain a maximum value for the fee valid for the particular tariff class. The data type shall be **MaxFee**.

The data type **MaxFee** allows the specification of different maximum fee values

- per day,
- per week,
- per month or
- per year.

The value shall be given in data type **Int4** and in the currency and currency units that are specified by the data element **standardCurrency** in the data element **tariffTable**.

NOTE 3 This parameters may be used e.g. in cordon pricing schemes to cap the maximum fee due per day in case of multiple passages of the cordon border.

EXAMPLE 8 A **maxFee** value of 11650 and **currency** value of “EUR” specifies 116,50 EUR maximum fee.

The optional data element **alternativeCurrency** shall be used to specify an alternative currency in case the Toll Context uses more than one currencies (e.g. for particular user groups or because of legal reasons). If this data element is present for this particular tariff class (identified by a tariff class ID) the alternative currency specified in the data element **alternativeCurrency** shall be valid instead of the standard currency that is specified in the attribute Tariff Table. However, the data provided in the elements **basicFeePerChargeUnit**, **offsetFee**, **thresholdFee**, **minFee** and **maxFee** shall still be given in the currency and units specified in the tariff table. In such case a conversion rate shall be applied between the two currencies. The conversion rates for alternative currencies are provided in the attribute **CurrencyConversionTable** (refer to clause 8.3.3.2.3). The data type of the data element **alternativeCurrency** shall be **Currency**. The data type **Currency** provides the currency identification as specified in ISO 4217.

8.3.3.2.3 EFC attribute **CurrencyConversionTable**

The tariff conversion table shall be presented in the EFC attribute **CurrencyConversionTable**.

Structure and data elements of the EFC attribute **CurrencyConversionTable** are given in Table 6 and defined in Annex A.

Table 6 — EFC attribute **CurrencyConversionTable (informative)**

EFC Attribute	Data element	Data Type	Remark
CurrencyConversionTable	alternativeCurrency	Currency	
	conversionRate	Int4	
	CurrencyConversionTableVersion	VersionAndValidity	
	CurrencyConversionTableAuthenticator	MessageAuthenticator	optional

For each toll domain a standard currency shall be defined in the Tariff Table (data element **standardCurrency** as specified in clause 8.3.3.2).

The attribute **CurrencyConversionTable** shall contain conversion rates that are applicable in case the toll context applies more than one currency for the calculation of the fees due.

NOTE Additional currencies may e.g. apply for particular user groups or for legal reasons.

Alternative currencies that are in use shall be specified individually per tariff class (refer to clause 8.3.3.2.2) for which they apply. In case an alternative currency is specified in data element **Tariff** the attribute **CurrencyConversionTable** shall be present.

The currency conversion table contains per alternative currency a conversion rate that is applicable in relation to the standard currency.

The element **alternativeCurrency** identifies the individual currency by its currency code. The data type shall be **currency**, which provides the coding as specified in ISO 4217.

The data element **conversionRate** provides the conversion rate between the respective alternative currency and the standard currency. The data type shall be **int4**. The value shall be given in 0,0001 major units of the alternative currency compared to one major unit of the standard currency.

The following formula shall apply:

$$Value_in_alternative_currency = Value_in_standard_currency \times conversion_rate$$

EXAMPLE1 The standard currency is specified as EUR. The alternative currency is specified as NOK. The exchange rate is 7,6771 NOK = 1 EUR. In this scenario the value in the data element **conversionRate** shall be 76771.

EXAMPLE The standard currency is specified as EUR. The alternative currency is specified as HUF. A basic fee per charge unit for the particular tariff class is specified with 0,11 EUR. The value in the element **conversion rate** is set to 2948500. The calculated basic fee per charge unit in the alternative currency is 32,4335 HUF (0,11 EUR x 2948500 x 0,0001).

The data element **CurrencyConversionTableVersion** shall contain version and validity information for the EFC attribute **CurrencyConversionTable**. The data type shall be **VersionAndValidity**. For details refer to clause 6.2.

The data element **CurrencyConversionTableAuthenticator** shall contain a message authenticator valid for the EFC attribute **CurrencyConversionTable**. The data type shall be **MessageAuthenticator** defined in ISO 17575-1. The data element **CurrencyConversionTableAuthenticator** shall be optional.

8.3.3.3 Tariff class definition

Tariff classes are always considered to be toll regime specific. Tariff classes depend on one or more of the following determinants

- vehicle class
- time class
- location class
- user class.

The four tariff determinants can be defined and used completely independent from each other (orthogonal).

Each valid combination of the tariff determinants vehicle class, time class, location class and user class shall lead to one tariff class (Figure 8).

NOTE A “combination” means a logical AND of the four tariff determinants.

Different combinations of the tariff determinants may lead to the same tariff class.

EXAMPLE Both combinations {t1; v4; u34; l21} and {t4; v4; u34; l23} may lead to tariff class 345.

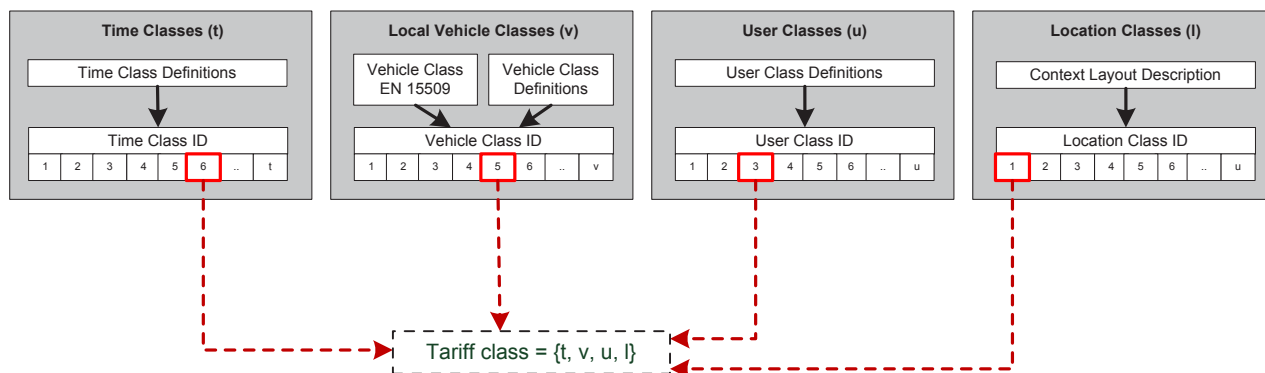


Figure 8 — Principle of creation of tariff classes

There shall be only one applicable tariff class for a user with one single contract for one single vehicle (with a given and fixed characteristic) as long as the vehicle uses one single charge object (with one single location class) at a specific point in time.

8.3.3.3.1 EFC attribute TariffClassDefinition

Tariff classes shall be defined in the EFC attribute `TariffClassDefinition`.

Structure and data elements of the EFC attribute `TariffClassDefinition` are given in Table 7 and defined in Annex A.

Table 7 — EFC attribute `TariffClassDefinition` (informative)

EFC Attribute	Data element	Data Type	Remark
TariffClassDefinition	<code>tariffClasses</code>	SEQUENCE OF <code>TariffClass</code>	
	<code>tariffClassDefinitionVersion</code>	<code>VersionAndValidity</code>	
	<code>tariffClassDefinitionAuthenticator</code>	<code>MessageAuthenticator</code>	optional

The data element `tariffClasses` shall contain a list of data types `TariffClass`. This data type is described in clause 8.3.3.3.2.

The data element `tariffClassDefinitionVersion` shall contain version and validity information for the EFC attribute `TariffClassDefinition`. The data type shall be `VersionAndValidity`. For details refer to clause 6.2.

This standard supports different versioning concepts for tariffs, tariff classes, vehicle classes, time classes, user classes and location classes. Changes in tariffs and/or class definitions that apply in the operational lifetime of EFC schemes can e.g. be applied the following manner (non-exhaustive list):

- applying the same tariff / class ID after a change in tariffs or class definitions, but using the version and validity data elements in order to identify and specify respective changes in tariffs and classes;
- applying a new tariff / class ID that was not used before the change in tariffs or class definitions and specifying the tariff classes in a way that they comprise only those vehicle / location / time / user classes are effective after the change in tariffs or class definitions.