

BS EN ISO 12855:2015



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Electronic fee collection — Information exchange between service provision and toll charging

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National foreword

This British Standard is the UK implementation of EN ISO 12855:2015. It supersedes BS EN ISO 12855:2012 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EPL/278, Intelligent transport systems.

A list of organizations represented on this committee can be obtained on request to its secretary.

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English Version

Electronic fee collection - Information exchange between
service provision and toll charging (ISO 12855:2015)

Perception du télépéage - Échange d'informations
entre la prestation de service et la perception du péage
(ISO 12855:2015)

Elektronische Gebührenerhebung -
Informationsaustausch zwischen Dienstleistern und
Gebühreneinzugsunternehmen (ISO 12855:2015)

This European Standard was approved by CEN on 7 November 2015.

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European foreword

This document (EN ISO 12855:2015) has been prepared by Technical Committee ISO/TC 204 "Intelligent transport systems" in collaboration with Technical Committee CEN/TC 278 "Intelligent transport systems" the secretariat of which is held by NEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2016, and conflicting national standards shall be withdrawn at the latest by June 2016.

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

This document supersedes EN ISO 12855:2012.

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Endorsement notice

The text of ISO 12855:2015 has been approved by CEN as EN ISO 12855:2015 without any modification.

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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.

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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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 204, *Intelligent transport systems*.

This second edition cancels and replaces the first edition (ISO 12855:2012), which has been technically revised. The following changes have been made:

- adding new Application Data Units (ADUs) due to comments received from National Bodies;
- aligning the ASN.1 data definitions with the current versions of EN 14906, and ISO 17575 (all parts);
- moving the ASN.1 module from [Annex A](#) to an external text file, in a format that can be processed by ASN.1 compilers;
- clarifying the semantics of parameters in ADUs;
- aligning the structure of all major clauses in a consistent manner to improve readability.

Introduction

The widespread use of tolling requires provisions for users of vehicles that circulate through many different toll domains. Users should be offered a single contract for driving a vehicle through various toll domains. Where those vehicles require a form of on-board equipment (OBE) this should be interoperable with the toll systems in the various toll domains. In Europe, for example, this need has been officially recognized and legislation on interoperability has already been adopted (see Directive 2004/52/EC and Decision 2009/750/EC). There is both a commercial and economic justification in respect to the OBE and the toll systems for standards enabling interoperability.

The system architecture defined in ISO 17573 is the basis for all standards that relate to tolling systems in the toll domain. With respect to ISO 17573, this International Standard

- adopts its definitions of terms and concepts and basic system functionalities and structure,
- uses its terminology, and
- specifies the interfaces therein identified.

ISO 17573 uses ISO/IEC 10746-3 for the description of the architecture.

[Figure 1](#) shows the scope of the group of electronic fee collection (EFC) related standards based upon the architecture standard.

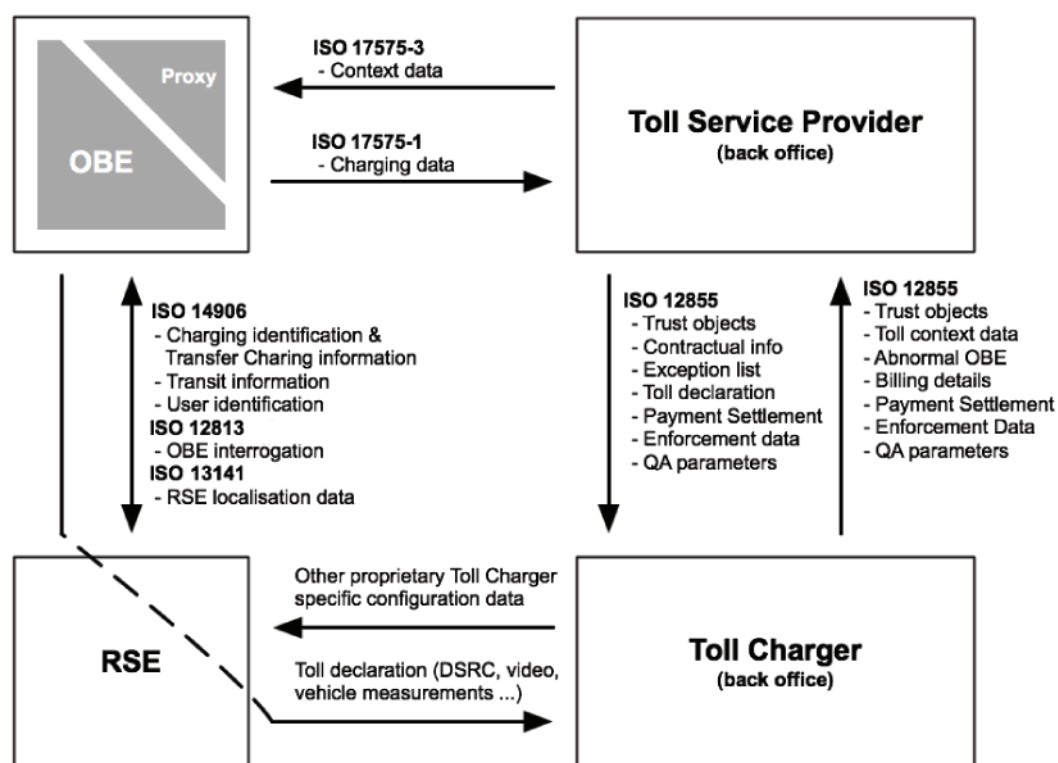


Figure 1 — Scope of EFC related standards

A given transport service for a given vehicle is fully identified by one or several toll declarations made available to the Toll Charger (TC). Toll declarations have to be made available according to the rules of the toll regime of the toll domain.

The amount due for a given transport service used by a vehicle liable to toll is finalized by the TC with the use of toll declarations (as described above) and calculation is made according to the rules of the toll regime (formula, tariff tables, specific situations rules, traffic conditions, etc.). That means that the

TC has the authority to decide on the amount due, even if it decides to assign the Toll Service Provider (TSP) the task to calculate the amount due.

The information above, associated with a given transport service, is named billing details; for a given transport service, the billing details are referring to one or several toll declarations.

Depending on the toll regime, billing details are elaborated with information collected by the TC and/or the relevant TSP; they are finalized by the TC.

The TC elaborates and makes the payment claims (or toll payment claims) available to each TSP, according to the bilateral agreements it has with each TSP, referring to billing details. These payment claims include an amount due taking into account any specific commercial conditions applicable to a vehicle, a fleet of vehicles or a given TSP.

This International Standard defines a set of interactions in support of technical interoperability between back-office systems of TCs and TSPs. The EFC-service and the EFC System model on which this International Standard is based is defined in ISO 17573.

This International Standard does not provide a full solution for interoperability, and it does not define other parts of the EFC system, other services, other technologies and non-technical elements of interoperability.

The development of a common European Electronic Toll Service (EETS) as a part of the European EFC Directive (2004/52/EC) also calls for the definition of an interoperable EFC service. This International Standard provides for effective support for the work on the definition of EETS. Details on the usage of this International Standard for the EETS are provided in [Annex F](#).

This International Standard identifies and specifies the set of Application Protocol Data Units exchanged between two actors in the roles of Toll Service Provider and Toll Charger as defined in ISO 17573. To specify these interfaces, this International Standard uses the enterprise description of the toll environment, and the interactions defined between the named classes of roles, as defined in ISO 17573. This allows for a complete specification of the data that is transferred between those identified entities. In addition, a number of computational interfaces are identified and interactions in terms of sequences of Application Protocol Data Units are defined.

Electronic fee collection — Information exchange between service provision and toll charging

1 Scope

This International Standard specifies

- the interfaces between electronic fee collection (EFC) systems for vehicle related transport services, e.g. road user charging, parking and access control; it does not cover interfaces for EFC systems for public transport; an EFC system can include any EFC system, e.g. including systems that automatically read licence plate numbers of vehicles passing a toll point,
- an exchange of information between the central equipment of the two roles of service provision and toll charging, e.g.
 - charging related data (toll declarations, billing details),
 - administrative data, and
 - confirmation data,
- transfer mechanisms and supporting functions,
- information objects, data syntax and semantics,
- examples of data interchanges (see [Annex C](#) and [Annex D](#)), and
- an example on how to use this International Standard for the European Electronic Tolling Service (EETS) (see [Annex F](#)).

This International Standard is applicable for any toll service and any technology used for charging.

It is defined as a toolbox standard of transactions and Application Protocol Data Units (APDUs), which can be used for the assigned purpose. The detailed definitions of mandatory and optional elements in a real implementation are defined elsewhere. It does not define all communication sequences, communication stacks and timings.

The scope of this International Standard is illustrated in [Figure 2](#). The data types and associated coding related to the data elements described in [Clause 6](#) are defined in [Annex A](#), using the abstract syntax notation one (ASN.1) according to ISO/IEC 8824-1.

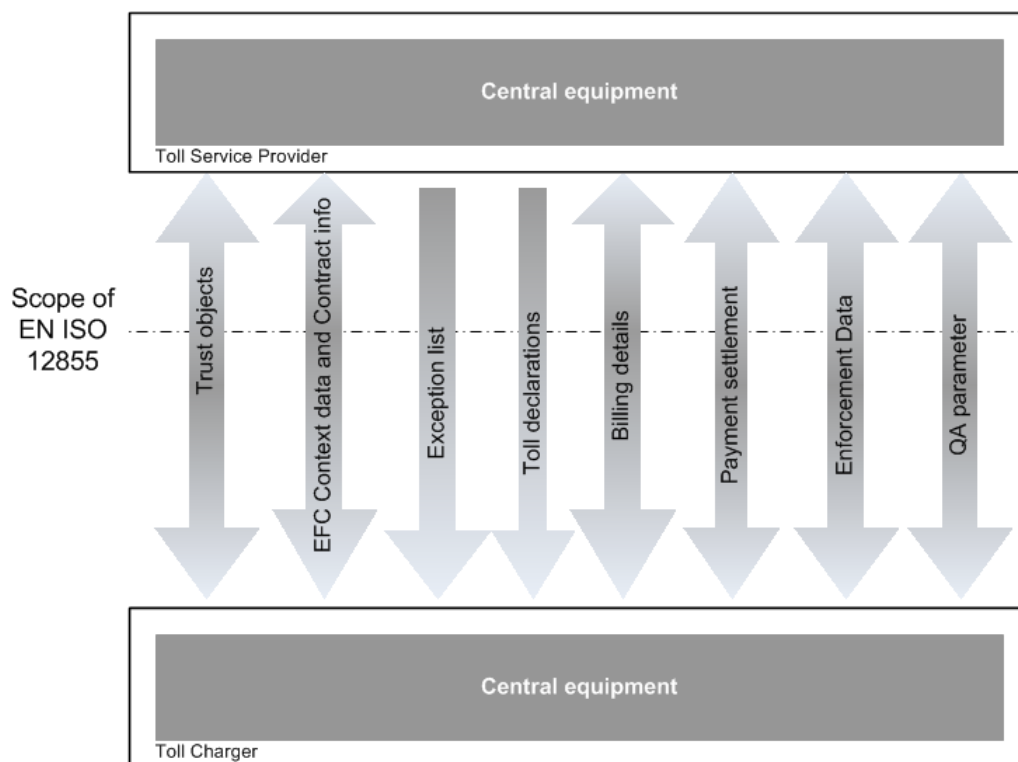


Figure 2 — Scope of this International Standard

This International Standard is not applicable to

- any communication between Toll Charger (TC) or Toll Service Provider (TSP) with any other involved party,
- any communication between elements of the TC and the TSP that is not part of the back office communication,
- processes regarding payments and exchanges of fiscal, commercial or legal accounting documents, and
- definitions of service communication channels, protocols and service primitives to transfer the APDUs.

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 639-1, *Codes for the representation of names of languages — Part 1: Alpha-2 code*

ISO 3166-1, *Codes for the representation of names of countries and their subdivisions — Part 1: Country codes*

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

ISO/IEC 8825-4, *Information technology — ASN.1 encoding rules: XML Encoding Rules (XER)*

ISO/IEC 9594-8:2014, *Information technology — Open Systems Interconnection — The Directory — Part 8: Public-key and attribute certificate frameworks*

ISO/IEC 9646-7, *Information technology — Open Systems Interconnection — Conformance testing methodology and framework — Part 7: Implementation Conformance Statements*

ISO/IEC 9797-2:2011, *Information technology — Security techniques — Message Authentication Codes (MACs) — Part 2: Mechanisms using a dedicated hash-function*

ISO/IEC 10118-3, *Information technology — Security techniques — Hash-functions — Part 3: Dedicated hash-functions*

ISO/IEC 11770-3, *Information technology — Security techniques — Key management — Part 3: Mechanisms using asymmetric techniques*

ISO/IEC 14888-2:2008, *Information technology — Security techniques — Digital signatures with appendix — Part 2: Integer factorization based mechanisms*

ISO 14906:2011/Amd1:2015, *Electronic fee collection — Application interface definition for dedicated short-range communication*

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

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

ISO 17575-3:—¹⁾, *Electronic fee collection — Application interface definition for autonomous systems — Part 3: Context data*

ISO/IEC 18033-2:2006, *Information technology — Security techniques — Encryption algorithms — Part 2: Asymmetric ciphers*

ISO/TS 19299:2015, *Electronic fee collection — Security framework*

IETF RFC 2634, *Enhanced Security Services for S/MIME*, June 1999

IETF RFC 4347, *Datagram Transport Layer Security*, April 2006

IETF RFC 5035, *Enhanced Security Services (ESS) Update: Adding CertID Algorithm Agility*, August 2007

IETF RFC 5246, *The Transport Layer Security (TLS) Protocol*, August 2008

IETF RFC 5746, *Transport Layer Security (TLS) Renegotiation Indication Extension*, February 2010

IETF RFC 6040, *Tunnelling of Explicit Congestion Notification*, February 2013

3 Terms and definitions

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

3.1

billing detail

information needed to determine or verify the amount due for the usage of a given service

Note 1 to entry: If the data are accepted by both the Toll Charger and the Toll Service Provider then the term used is “concluded billing detail”, which can be used to issue a payment claim.

Note 2 to entry: For a given transport service, the billing detail refers to one or several valid toll declaration(s). A valid billing detail has to fulfil formal requirements, including security requirements, agreed between the Toll Service Provider and the Toll Charger.

1) To be published.

3.2

black list

list of users for which the service provider denies contractual responsibility

Note 1 to entry: The service provider in the context of this International Standard is the Toll Service Provider (TSP).

3.3

charge report

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

Note 1 to entry: In European Decision 2009/750/EC, a charge report is referred to as a “toll declaration”.

[SOURCE: ISO 17575-1:—, 3.6]

3.4

charging data

relevant data on the usage of a certain service

3.5

computational specification

decomposition of a system into objects performing individual functions and interacting at well-defined interfaces

3.6

electronic fee collection

EFC

fee collection by electronic means

3.7

enforcement

measures or actions performed to achieve compliance with laws, regulations or rules

Note 1 to entry: In this context: the process of compelling observance of a toll regime.

3.8

interoperability

ability of systems to exchange information and to make mutual use of the information that has been exchanged

Note 1 to entry: For tolling, interoperability aims at enabling a vehicle to drive through various toll domains while having only one on-board equipment operating under one contract with a Toll Service Provider.

[SOURCE: ISO/IEC TR 10000-1:1998, 3.2.1, modified.]

3.9

on-board equipment

OBE

all required equipment on-board a vehicle for performing required *EFC* ([3.6](#)) functions and communication services

3.10

payment claim

recurring statement referring to concluded *billing details* ([3.1](#)) made available to the payer by the payee indicating and justifying the amount due

Note 1 to entry: The payment claim is used by the Toll Service Provider to issue financial objects to its customers (e.g. invoices on behalf of the Toll Charger). A given toll payment claim refers to *billing details* ([3.1](#)) and takes into account any specific commercial conditions applicable to a vehicle, a fleet of vehicles, a customer of a Toll Service Provider and/or a Toll Service Provider. A valid “payment claim” has to fulfil formal requirements, including security requirements, agreed between the Toll Service Provider and the Toll Charger.

3.11
roadside equipment
RSE

equipment located along the road, either fixed or mobile

3.12
tariff scheme

set of rules to determine the fee due for a vehicle within a *toll domain* (3.17)

EXAMPLE A table that shows the fee for various classes of vehicles.

3.13
toll

charge, tax or duty levied in relation with using a vehicle in a *toll domain* (3.17)

Note 1 to entry: The definition is a 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.

3.14
toll charger
TC

entity which levies *toll* (3.13) for the use of vehicles in a *toll domain* (3.17)

Note 1 to entry: In other documents the terms “operator” or “toll operator” can be used.

[SOURCE: ISO 17573:2010, 3.16, modified — “legal” has been deleted from before “entity” and “the use of” has been added.]

3.15
toll context data

information defined by the responsible *Toll Charger* (3.14) necessary to establish the *toll* (3.13) due for using a vehicle on a particular toll context and to conclude the toll transaction

[SOURCE: ISO 12855:2015, 3.15]

3.16
toll declaration

statement to declare the usage of a given *toll* (3.13) service to a *Toll Charger* (3.14)

Note 1 to entry: A valid toll declaration has to fulfil formal requirements, including security requirements, agreed between the *Toll Service Provider* (3.19) and the *Toll Charger* (3.14).

[SOURCE: ISO/TS 19299:2015, 3.44]

3.17
toll domain

area or a part of a road network where a certain *toll regime* (3.18) is applied

[SOURCE: ISO 17573:2010, 3.18, modified — “certain” has been added.]

3.18
toll regime

set of rules, including *enforcement* (3.7) rules, governing the collection of *toll* (3.13) in a *toll domain* (3.17)

[SOURCE: ISO 17573:2010, 3.20]

3.19
toll service provider
TSP

entity providing *toll* (3.13) services in one or more *toll domains* (3.17)

Note 1 to entry: In other documents the terms “issuer” or “contract issuer” can be used.

Note 2 to entry: The *Toll Service Provider* (3.19) can provide the *on-board equipment* (3.9) or can provide only a magnetic card or a smart card to be used with *on-board equipment* (3.9) provided by a third party.

Note 3 to entry: The *Toll Service Provider* (3.19) is responsible for the operation (functioning) of the *on-board equipment* (3.9).

[SOURCE: ISO 17573:2010, 3.23, modified — the definition has been condensed.]

3.20

trust object

information object that is exchanged between entities to ensure mutual trust

EXAMPLE An electronic signature or an electronic certificate.

[SOURCE: ISO 17573:2010, 3.28]

3.21

white list

list of users for which the service provider accepts contractual responsibility

Note 1 to entry: The service provider in the context of this International Standard is the *Toll Service Provider* (3.19).

Note 2 to entry: An entry on a white list is independent of entries on a *black list* (3.2).

4 Symbols and abbreviated terms

ADU	Application data unit (ISO 14906)
ANPR	Automatic Number Plate Reading
APCI	Application Protocol Control Information
APDU	Application Protocol Data Unit (ISO 14906)
CCC	Compliance Check Communication (ISO 12813)
CRL	Certificate revocation list
DSRC	Dedicated short-range communication (ISO 14906)
DTLS	Datagram Transport Layer Security
EFC	Electronic Fee Collection (ISO 17573)
GNSS	Global Navigation Satellite System
HTTPS	Hyper-Text Transfer Protocol Secure
ICS	Implementation Conformance Statement
IEC	International Electrotechnical Commission
IUT	Implementation Under Test
ITU	International Telecommunication Union
LPN	Licence Plate Number
OBE	On-Board Equipment (ISO 14906)
OBU	On-Board Unit
OCSP	Online Certificate Status Protocol

OSI	Open Systems Interconnection
PAN	Personal Account Number (ISO 14906)
QA	Quality Assurance
RSA	Rivest, Shamir and Adleman (ISO/TS 19299)
RSE	Roadside Equipment (ISO 14906)
SLA	Service Level Agreement
SU	Service User
SUT	System Under Test (ISO/TS 14907-1)
TC	Toll Charger
TLS	Transport Layer Security
TSP	Toll Service Provider
VRM	Vehicle Registration Mark

NOTE RSA is an algorithm for public-key cryptography, also referred to as asymmetrical cryptographic technique.

5 Architectural concepts and information exchanges

5.1 Main roles in the toll charging environment

This International Standard is built upon ISO 17573.

ISO 17573 defines the four main roles shown in [Figure 3](#).

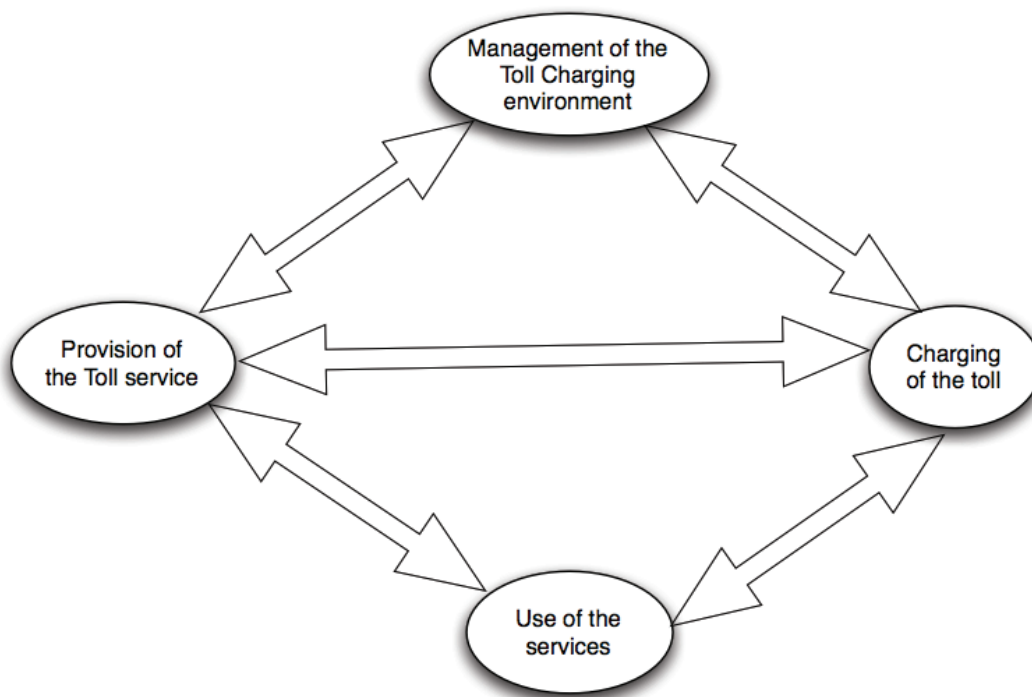


Figure 3 — Roles in the toll charging environment

Information exchanges are agreed upon between Toll Charger and Service Provider, taking into account privacy regulations. The information exchanges needed by the Toll Charger and the Toll Service Provider to perform their roles are described in this Clause 5.

5.2 Information exchange between toll charging and provision

5.2.1 General

The information exchange between the service provision and the toll charging roles supports the provision of functionalities that are based on the EFC system behaviour definitions in ISO 17573.

These functionalities are listed below, in the order they are given in [Clauses 5](#) and [6](#):

- basic protocol mechanisms;
- exchange trust objects;
- exchange of EFC context data and contractual information;
- manage exception list;
- report toll declarations;
- report billing details;
- payment settlement:
 - claim payment for service usage;
 - announce payments;
- exchange enforcement data (includes user details);

- exchange quality assurance parameters.

This International Standard leaves implementers the freedom of defining suitable protocol procedures, i.e. for complex transactions. Therefore, it only defines

- a basic interaction protocol (request – response) for information exchange,
- basic protocol mechanisms, to be used to build more complex protocol procedures, and
- the semantics and the format of the APDUs that are exchanged.

These functionalities are described in [5.2.2](#) to [5.2.11](#).

5.2.2 Basic interaction protocol

Information exchanges are performed by means of APDU transfers.

Some APDU transfers need to be acknowledged. When this happens, related protocol procedures are specified. This International Standard defines no provisions for complex transfers (transactions), i.e. APDU transfers that cover several APDUs. Instead, this International Standard defines basic protocol mechanisms to be used by implementations that need to define and perform transactions.

5.2.3 Basic protocol mechanisms

5.2.3.1 General approach

This International Standard provides the following basic protocol mechanisms, which shall be implemented to exchange information between the Toll Service Provider's and the Toll Charger's central equipment. These basic protocol mechanisms consist of

- an identification schema for the APDUs that are exchanged,
- a generic interaction (i.e. not related to any specific functionality) that allows requesting a specific information exchange from the counterpart. This interaction is provided by the "request" ADU,
- a generic acknowledge mechanism (i.e. not related to any specific functionality) that allows acknowledging a specific interaction. The "ack" ADU provides this mechanism, and
- an optional generic status mechanism (i.e. not related to any specific functionality) that allows providing status information for a specific interchange. This mechanism is provided by the "status" ADU.

By means of the above mechanisms, an implementation can build more complex protocol procedures, including rollback, recovery, checkpointing or restart.

This International Standard does not specify timings and retry procedures for acknowledgements. Timeouts can be defined as agreements between Toll Charger and Toll Service Provider to cover the case of missing acknowledgements. To handle any lost APDUs a timeout system can be implemented.

5.2.3.2 Identification schema

Each interaction is performed by means of one or more APDU exchanges. Each APDU shall contain a unique identifier in the namespace of the originator of the APDU. The combination of originator identifier and APDU identifier ensures that all APDUs are uniquely identified.

5.2.3.3 Request functionality

The "request" functionality shall be used to

- alert the counterpart that one is ready to accept any kind of information exchange,

- inform the counterpart that one is ready to accept a specific type of ADU, by indicating the type of ADU one is ready to accept,
- request the counterpart re-issue a specific APDU, by indicating the type and the identifier of the APDU, and
- request information identified by type and ADU content.

5.2.3.4 Acknowledgement functionality

The “acknowledgement” functionality shall be used to inform the counterpart that a specific ADU has been received correctly, or errors have been detected, or it is not supported.

5.2.3.5 Status functionality

The “status” functionality can be used to provide the counterpart with general status information on the interface or inform it about a status on previously transferred information. It may be used to

- provide general information on the status of the interface,
- alert the counterpart that some previously provided information becomes invalid without any new information being currently available, and
- alert the counterpart that the previous information contained an error and has to be recalled.

5.2.4 Exchange trust objects functionality

The “exchange trust objects” functionality is derived from the EFC system behaviours “adding (or excluding) a new Toll Charger” and “adding (or excluding) a new Service Provider”. Actions performed when executing the above behaviours shall exchange trust objects to be used in order to secure their bilateral communication. The functionality may also be used whenever an entity sees the need to update its own trust objects or another entity may ask for the update of an already existing trust object.

NOTE Examples of trust objects are: asymmetric public keys, certificates, symmetric keys and certificate revocation lists.

Either the Toll Service Provider or Toll Charger can use the exchange trust objects functionality.

The initiator of the exchange can request the receiver to send trust objects by means of a “request” ADU. The “request” ADU may contain an optional indicator that specifies already issued trust objects to be resent. When no indicator is specified, the trust objects to be transferred shall be the current ones.

After receiving a “request” ADU that asks for trust objects, the requested trust objects are newly generated (or retrieved) by the recipient of the request and sent to the requesting party who shall acknowledge the reception by issuing an “ack” ADU.

If either party decides at any time to update any own trust objects, it can deliver them to any counterpart without waiting for a “request” ADU.

The receiver of trust objects shall acknowledge the reception by issuing an “ack” ADU.

After acknowledgement, the exchanged trust objects shall be considered immediately valid unless they contained a validity starting date. The validity period in this last case shall start from the time indicated in the trust objects.

5.2.5 Exchange of EFC context data and contractual information functionality

5.2.5.1 Originating and providing EFC context data functionality

The “originating and providing EFC context data” functionality is derived from ISO 17573 as defined in the EFC system behaviour “adding, modifying or closing a toll regime”.

The “originating and providing EFC context data” functionality may be used by a Toll Charger when any change of a toll domain or toll regime occurs, including the start of a new toll domain, by issuing an “EFC context data” ADU.

Any Toll Service Provider may request from any Toll Charger at any time and for any reason to send the current or any previous version of the toll context data for a toll domain under its responsibility. This operation is performed by means of a “request” ADU.

Reception of an “EFC context data” ADU shall be acknowledged by means of an “acknowledge” ADU.

The information describing a toll regime uses one or more sets of EFC Context Data. It is defined through its tolled objects and the rules associated with them. EFC Context Data elements are defined in detail in ISO 17575-3, and are extended in this International Standard for DSRC-based and other tolling systems.

Other toll regime properties to be configured by the Toll Charger are the interrelations a toll regime may have in relation to others. These rules and configuration parameters are defined in ISO 17575-3 and are addressed within this International Standard as Toll Context interrelations.

5.2.5.2 Contractual information functionality

The contractual information functionality allows a Toll Service Provider to deliver to the Toll Charger any type of user contract related information that is stored in the OBEs, among which the personal account number (PAN), the supported security level and the key set to be used in the calculation of DSRC authenticators. This functionality allows the Toll Charger to compare data that is stored in the OBEs with information received by the Toll Service Provider.

5.2.6 Manage exception list functionality

5.2.6.1 General

The “manage exception list” functionality originates from ISO 17573 and is defined in the EFC system behaviours “collecting toll information – user billing” and “collecting charging information (autonomous systems)”.

NOTE 1 This International Standard uses the term “exception list” to summarize all possibilities of limiting the usability of an OBE or giving information on the special handling of an OBE in a toll regime. Other standards can use different terms, but they are all included in the term “exception list”.

NOTE 2 The conditions and the periods of time that an OBE can be accepted within a toll regime are limited by putting it on the exception list or removing it. This is solely the responsibility of the Toll Service Provider that issued the OBE. Any information sufficient for the identification of a specific vehicle or OBE by the Toll Charger (e.g. OBE ID, PAN, licence plate) can be included in the exception list as agreed between TC and TSP.

5.2.6.2 Exception list entry requested by a Toll Charger

A Toll Charger may use the “manage exception list” functionality when it registers violations by a specific Service User or wrong technical behaviour by a specific OBE.

NOTE 1 In this case the Toll Charger can issue a “report abnormal OBE” ADU to request the inclusion of this OBE in the exception list.

The Toll Service Provider shall acknowledge the inclusion of the OBE on the exception list by means of an ack ADU.

NOTE 2 This can be due to non-conforming behaviour of the Service User or of a malfunctioning OBE or others.

5.2.6.3 Exception list entry decided by the Toll Service Provider

A Toll Service Provider can unilaterally add, modify or delete items in its exception list.

The functionality is performed by issuing the “exception list” ADU. This offers the Toll Service Provider the opportunity to provide any information about an OBE of a Service User to the Toll Charger.

NOTE 1 The ADU can include, among others, one of the following reasons:

- the Toll Service Provider has terminated its support/responsibility for a vehicle/OBE;
- an OBE was lost or stolen;
- the Toll Service Provider has started/accepted its support/responsibility for a vehicle/OBE;
- the Toll Charger is informed about the commercial conditions to apply to an OBE (e.g. discount for a group of vehicles).

NOTE 2 The exception list can be used to provide additional information on a vehicle/OBE for a toll regime (e.g. specific commercial conditions) and/or limit or restrict the acceptance of an OBE within a toll regime operated via the road infrastructure of a Toll Charger, where an exchange of data between Toll Service Provider and Toll Charger is needed.

NOTE 3 The exception list can be used to provide information on the country of registration of a vehicle and a VAT ID number to allow a Toll Charger the correct application of VAT for ferry operations, where this information is needed for handling of reverse charge VAT in the EU.

Upon reception the Toll Charger may semantically check the received exception list. If an error is detected in the exception list, the whole exception list shall be disputed by sending an ack ADU indicating the detected error.

The Toll Service Provider may then rectify the problem and transmit a new exception list. Until a valid exception list is transmitted, the last correct list remains active in the systems of the Toll Charger.

If a new valid exception list is received by the Toll Charger it shall be acknowledged by sending an ack ADU.

5.2.7 Report toll declarations functionality

The “report toll declarations” functionality originates from ISO 17573 and is defined in the EFC system behaviour “collecting charging information (autonomous systems)”.

NOTE 1 The charging data generated by an OBE is used to report a Service User entering, moving around in or leaving a toll domain. A service usage statement with an amount due can be made either by a single tolled object or by a combination of several tolled objects. Any service usage is reported as charging data through an exchange of data between an OBE/proxy (Front End system) and the central equipment (Back End system) managed by a Toll Service Provider. This interface between Front End and Toll Service Provider is specified in ISO 17575-1 ISO 17575-2 and ISO 17575-3 and is not covered by this International Standard.

The gathered charging data shall be collected in the central system of the Toll Service Provider. If the Toll Service Provider needs to enrich the charging data in its central equipment, it may do so before sending it as toll declarations to the Toll Charger who offered the transport service. This optional possibility to enrich the charging data enables the concept of shared user data, where only limited information may be included in the OBE, while the rest is held centrally at the issuing Toll Service Provider.

The toll declarations shall contain all information required by the Toll Charger to calculate the amount due for the use of a toll domain or to verify the calculation done by the Toll Service Provider. The Toll Charger in the EFC context data defines details about configuration parameters for toll declarations.

A toll declaration shall be reported to the Toll Charger operating a toll domain, by means of a “toll declaration” ADU.

NOTE 2 The toll declarations can be delivered periodically in an agreed frequency (e.g. weekly, daily, hourly, in real time ...) or upon triggering the delivery and with the quantity of information agreed for a toll regime.

The Toll Charger shall acknowledge the received “toll declaration” ADU by indicating for each toll declaration whether it is accepted or not by means of an “ack” ADU. If a toll declaration is not accepted, this has to be handled in a dispute phase, which is outside the scope of this International Standard.

If the Toll Charger detects a contradiction between the toll declarations provided by the Toll Service Provider and its own data (e.g. Compliance Check Communication (CCC) data, LPN reading, etc.), it may ask the Toll Service Provider for additional information about the provided toll declarations for this specific vehicle or Service User. The Toll Charger may send a “request” ADU to the Toll Service Provider to provide any detailed toll declarations for a specific Service User and/or a specific period of time.

NOTE 3 This enables the Toll Charger to receive only daily summation records of the use of its toll domain from the Toll Service Provider and to produce its billing details in normal operation without any detailed knowledge about each segment passed by an OBE. When the Toll Charger detects a contradiction in the provided high level toll declarations during comparison with the CCC data it recorded, it can ask the Toll Service Provider for detailed toll declarations for this specific vehicle or Service User.

5.2.8 Report billing details functionality

Depending on its toll system a Toll Charger either acquires the toll declarations directly from the roadside equipment (RSE) it operates (e.g. DSRC-based systems) or via the Toll Service Provider’s central equipment (e.g. autonomous systems), which are then used for the generation of billing details.

A single billing detail may refer to one or several toll declarations. The generation of billing details is based on the requirements defined for the toll regime. Thus a billing detail may consist of

- an elementary usage of a transport service (e.g. regarding the toll for a road section),
- several usages of a transport service within a given period of time (a day, a week, a month ...), or
- several elementary usages of a transport service within a given journey.

If some relevant information is missing to build a billing detail out of toll declarations, it may be requested from the central equipment of the Toll Service Provider.

NOTE 1 This optional possibility to enrich the toll declarations enables the concept of shared user data, where only limited information is included in the OBE, while the rest is held centrally at the issuing Toll Service Provider.

The Toll Charger and Toll Service Provider can agree to aggregate the generated Billing details to reduce the number of lines to be processed in their bookkeeping systems for handling the payment claim between Toll Charger and Toll Service Provider. To avoid any rounding differences between the VAT declarations for the local tax authorities of the Toll Charger and the VAT shown on the invoices to the Service Users (SUs), the Toll Charger and the Toll Service Provider shall apply the same aggregation methods for the exchanged and acknowledged aggregated billing details, which need to be bilaterally agreed. Consequently, rounding rules are not defined in this International Standard.

NOTE 2 This can be achieved by one of the following measures, among others:

- after generating the billing details, the Toll Charger aggregates any billing details prior to claiming the payment, if this is bilaterally agreed. A unique identifier (reference number) for each aggregate is generated during aggregation and associated with all billing details in order to link them to the derived payment claim. By this method, the Toll Service Provider is always able to check the consistency of the payment claim with the billing details from which they stem;
- the Toll Charger and Toll Service Provider can agree to use the same aggregation process and aggregate the billing details independently from each other for the representation on the invoice in their own central equipment to avoid any rounding differences.

See informative [Annex E](#) for an example of one possible solution to deal with the aggregation of billing details.

The generated billing details shall be reported by means of a “billing detail” ADU. In a DSRC environment, this ADU is always generated by the Toll Charger, as it collects the toll declarations directly from its RSE. In a GNSS environment, this ADU may be either generated by the Toll Charger or the Toll Service Provider depending on the operational model of the Toll Charger.

NOTE 3 The operational model of the Toll Charger in a GNSS environment could require it to generate any billing details and keep complete control over the usage of its toll domain. This is typically the case for privately operated Toll Chargers or road concessionaires. If a government body conducts the role of Toll Charger, on the other hand, it may only want to do spot checks to avoid the operational workload of being a Toll Charger in a GNSS environment. In this case, the Toll Charger may require the Toll Service Provider to generate the billing details ADU to be sent to it.

The recipient may check the completeness and the conformity of the provided billing details for a given service usage. Therefore, the billing details may reference any toll declarations and thus provide information to the Toll Service Provider to check their authenticity.

The recipient shall acknowledge the received “billing detail” ADU by indicating for each billing detail whether it is accepted or not by means of an “ack” ADU.

5.2.9 Payment settlement functionality

5.2.9.1 Claim payment for service usage

The claim payment for service usage functionality is derived from ISO 17573 and is defined in the EFC system behaviour “claiming tolls”.

The claim payment phase starts once the billing details have been agreed between the Toll Charger and the Toll Service Provider (see [5.2.8](#)). The payment claim is based upon these agreed and possibly aggregated billing details.

If any specific commercial conditions were agreed (to be applied to the payment claim of a Service User) this may be included directly as a discount in the original payment claim, or it may be included at a later time in a separate payment claim as a credit note (e.g. when billing details for a whole month define the discount level of a scaled discount scheme).

Any additional claims for other services that do not directly derive from the bilaterally agreed billing details (e.g. overdue payment, reimbursement, penalties...) may be included as well.

The payment claim shall contain all the legal and fiscal information required, according to each toll regime, to be used for invoicing between the Toll Charger, the Toll Service Provider and the Service User.

NOTE 1 The payment claim can be used by the Toll Service Provider to generate invoices for its customers (Service Users) on behalf of the relevant Toll Charger or for its own account (if the Toll Service Provider is buying the toll from the Toll Charger and reselling it to the Service User).

The payment claim shall be put forward to the Toll Service Provider by means of a “payment claim” ADU.

The Toll Service Provider shall acknowledge the received “payment claim” ADU by indicating for each payment claim whether it is accepted or not by means of an “ack” ADU.

NOTE 2 Possible reasons for dispute, among others, are: inconsistency of payment claim with billing details or non-conformance of specific commercial conditions.

5.2.9.2 Payment announcement

The payment announcement for service usage functionality orientates itself on the payment claim functionality but is initiated by the Toll Service Provider or on request from the Toll Charger.

After billing details have been agreed between the Toll Charger and the Toll Service Provider, the Toll Service Provider sends a payment announcement to the Toll Charger informing it about all payments.

payment. This payment announcement may include references to billing details, toll declarations or even single elements of a charge report.

The Toll Charger shall acknowledge the received “payment announcement” ADU by indicating for each payment announcement whether it is accepted or not by means of an “ack” ADU.

5.2.10 Exchange enforcement data functionality

5.2.10.1 General

The “exchange enforcement data” functionality originates from ISO 17573 and is defined in the EFC system behaviour “exceptions detection – user and OBE compliance checking”.

The “exchange enforcement data” functionality may be used each time a Toll Charger needs additional information for a compliance checking process. The compliance checking process is concentrated on

- verifying if the Service User fulfils its obligation to co-operate, and
- gathering facts required for later performance monitoring and/or SLA evaluation.

A following off-line process performed by the Toll Charger may

- issue toll violation tickets for Service Users if the Service User was responsible for the wrong toll declaration, and
- compare roadside observations with toll declarations received from the Toll Service Provider and update the performance monitoring parameters with these results.

Even if the details on how to perform compliance checking/enforcement Back End processes are left to the Toll Chargers, some basic information exchange shall be supported on both sides.

5.2.10.2 Retrieve user details functionality

The “request” ADU may be used by a Toll Charger to ask the Toll Service Provider(s) whether they have a contractual relationship with a given Service User identified in the ADU and/or to provide additional details on a Service User by specifying the requested details.

This ADU can either be sent to a specific Toll Service Provider or broadcasted to a group or all Toll Service Providers.

5.2.10.3 Provide user details

After receiving a “request” ADU requiring user details, the Toll Service Provider may answer with a “provide user details” ADU, thus confirming a contractual relationship, or with an “ack” ADU with a specific reason code to decline any contractual relationship.

As a minimum, the Toll Service Provider shall confirm the existence of a contractual relationship with a Service User by providing one of the following data:

- personal Account Number (PAN, as defined in ISO 14906:2011/Amd1:2015);
- contract serial number;
- licence plate number;
- on-board equipment identification (OBE ID).

The Toll Service Provider shall provide any additional details on the Service User as specified in the “request” ADU to the best of its ability.

NOTE The delivery of user details can be subject to local data protection regulations.

The Toll Charger shall acknowledge any received “provide user details” ADU by means of an “ack” ADU.

5.2.10.4 Retrieve and report CCC event

The Toll Service Provider may send a “request” ADU to the Toll Charger to enquire about the details for any CCC events for a specific Service User and/or a specific period of time.

In this case, the Toll Charger shall answer to the received “request” ADU with a “report CCC event” ADU or it may send the “report CCC event” ADU of its own accord to inform the Toll Service Provider about any new CCC event.

The Toll Service Provider shall acknowledge any received “report CCC event” ADU by means of an “ack” ADU.

5.2.10.5 List of users

The list of users functionality provides support to the Toll Charger in its enforcement activities and is used to detect potential fraud in particular.

The Toll Charger can specify in a “request” ADU to the Toll Service Provider a specific userId (e.g. a licence plate number) and can request information on all other userIds (e.g. licence plate numbers) that belong to the same Service User (e.g. haulier).

5.2.11 Exchange quality assurance parameters functionality

The report quality assurance parameters functionality is derived from ISO 17573 and is defined in the EFC system behaviour “defining rules and monitoring operations”.

In ISO 17573, the report quality assurance parameters functionality is used to report and monitor the EFC activities of Toll Chargers and Toll Service Providers. In this International Standard, it is used additionally to exchange any information necessary to monitor the quality of operations between the Toll Charger and the Toll Service Provider.

One of these quality assurance parameters may be the detection rate (i.e. the percentage of detected OBE of a given Toll Service Provider in a given toll regime of a Toll Charger). As it is important for both the Toll Charger and the Toll Service Provider that the detection rate of the Toll Service Provider’s OBEs in a toll regime of a Toll Charger be as high as possible, this may need to be constantly monitored by an SLA level.

Types and ranges of QA parameters are agreed upon between Toll Chargers and Toll Service Providers with bilateral agreements.

The exchange of quality assurance parameters depends on the initiator of the exchange:

- the Toll Charger may send a quality assurance parameter by issuing a “report QA” ADU;
- the Toll Service Provider may request an update of a quality assurance parameter by sending a “request” ADU. The Toll Charger shall respond to the request by sending a “report QA” ADU;
- the Toll Service Provider may send a quality assurance parameter by issuing a “report QA” ADU;
- the Toll Charger may request an update of a quality assurance parameter by sending a “request” ADU. The Toll Service Provider shall respond to the request by sending a “report QA” ADU.

The receiver of a “REPORT QA” ADU shall acknowledge it by means of an “ack” ADU.

6 Computational specification

6.1 Overview

This clause specifies the computational objects for the information exchanges between Toll Chargers and Toll Service Providers. Each computational object is identified by

- a name,
- the function(s) it performs, and
- the Application Data Units (ADUs) it is able to generate or accept.

For the sake of simplicity, the functionalities identified in previous clauses correspond to computational objects here. This means that the functions performed by each object are already described in previous clauses. A given computational object can be instantiated for the Toll Service Provider or for the Toll Charger role, with the limitations and permissions stated as rules in the previous clauses. The fact that computational objects are modelled here as each having one logical interface for interactions does not put any limits on the number of real interfaces offered in an implementation of this International Standard.

[Table 1](#) lists the defined computational objects. For each object, the relevant interface interactions are listed, together with the limitations, permissions and obligations for each role derived by the rules defined in previous clauses.

An implementation conforming to this International Standard shall declare which of the computational objects listed in [Table 1](#) are supported, by completing the proforma protocol implementation conformance statement as defined in [Annex B](#). For each computational object the implementer declares to support, and depending on the implementation's role (Toll Charger or Toll Service Provider), the rules stated in [Table 1](#) shall be implemented, with the following meanings:

- may initiate: an entity is able and allowed to initiate an interaction;
- shall initiate: an entity is able and has to initiate an interaction;
- shall be able to receive: an entity shall be able to accept this kind of interaction. This means that responses to the related ADUs cannot bear an "ADU unknown" reason code.

Table 1 — Computational objects and interactions

Computational object	Interaction	Toll Service Provider rules	Toll Charger rules
Exchange trust objects	Request	May initiate, shall be able to receive	May initiate, shall be able to receive
	Trust objects	May initiate, shall be able to receive	May initiate, shall be able to receive
	Acknowledge	Shall initiate, shall be able to receive	Shall initiate, shall be able to receive
	Status	May initiate, shall be able to receive	May initiate, shall be able to receive

Table 1 (continued)

Computational object	Interaction	Toll Service Provider rules	Toll Charger rules
Originating and providing EFC context data and contractual information	Request (EFC context data)	May initiate	Shall be able to receive
	Request (contractual information)	Shall be able to receive	May initiate
	EFC context data	Shall be able to receive	May initiate
	Contractual information	May initiate	Shall be able to receive
	Acknowledge (EFC context data)	Shall initiate	Shall be able to receive
	Acknowledge (contractual information)	Shall be able to receive	Shall initiate
	Status	May initiate, shall be able to receive	May initiate, shall be able to receive
Manage exception list	Request (exception list)	Shall be able to receive	May initiate
	Request (abnormal OBE)	May initiate	Shall be able to receive
	Exception list	May initiate	Shall be able to receive
	Report abnormal OBE	Shall be able to receive	May initiate
	Acknowledge (exception list)	Shall be able to receive	Shall initiate
	Acknowledge (report abnormal OBE)	Shall initiate	Shall be able to receive
	Status	May initiate, shall be able to receive	May initiate, shall be able to receive
Toll declaration	Request	Shall be able to receive	May initiate
	Toll declaration	May initiate	Shall be able to receive
	Acknowledge	Shall be able to receive	Shall initiate
	Status	May initiate, shall be able to receive	May initiate, shall be able to receive
Report billing details	Request	May initiate, shall be able to receive	May initiate, shall be able to receive
	Billing details	May initiate, shall be able to receive	May initiate, shall be able to receive
	Acknowledge	Shall initiate, shall be able to receive	Shall initiate, shall be able to receive
	Status	May initiate, shall be able to receive	May initiate, shall be able to receive
Payment settlement	Request (payment claim)	May initiate	Shall be able to receive
	Request (payment announcement)	Shall be able to receive	May initiate
	Payment claim	Shall be able to receive	May initiate
	Payment announcement	May initiate	Shall be able to receive
	Acknowledge (payment claim)	Shall initiate	Shall be able to receive
	Acknowledge (payment announcement)	Shall be able to receive	Shall initiate
	Status	May initiate, shall be able to receive	May initiate, shall be able to receive

Table 1 (continued)

Computational object	Interaction	Toll Service Provider rules	Toll Charger rules
Exchange enforcement data	Request (user details)	Shall be able to receive	May initiate
	Request (CCC event)	May initiate	Shall be able to receive
	Request (list of users)	Shall be able to receive	May initiate
	Provide user details	May initiate	Shall be able to receive
	Report CCC event	Shall be able to receive	May initiate
	List of Users	May initiate	Shall be able to receive
	Acknowledge (user details)	Shall be able to receive	Shall initiate
	Acknowledge (report CCC event)	Shall initiate	Shall be able to receive
	Acknowledge (list of users)	Shall be able to receive	Shall initiate
	Status	May initiate, shall be able to receive	May initiate, shall be able to receive
Exchange quality assurance parameters	Request	May initiate, shall be able to receive	May initiate, shall be able to receive
	Report QA	May initiate, shall be able to receive	May initiate, shall be able to receive
	Acknowledge	Shall initiate, shall be able to receive	Shall initiate, shall be able to receive
	Status	May initiate, shall be able to receive	May initiate, shall be able to receive

The offering of an interface by an actor may require different behaviours depending on the activities to be performed with the exchange of information.

Interface interactions summarized in [Table 1](#) are performed by exchanging OSI application layer APDUs. They are described in detail in the following sections and formally defined in [Annex A](#). In case of any conflict between this description and the definition in [Annex A](#), the definition in [Annex A](#) takes precedence.

6.2 Application Protocol Data Units

6.2.1 General

The APDU content is formally defined in [Annex A](#) by the ASN.1 type InfoExchange, which is made of the following elements:

- 1) a mandatory **infoExchangeContent** field;
- 2) an optional **infoExchangeAuthenticator** field.

[Table 2](#) describes the fields in the infoExchange APDU.

Table 2 — InfoExchange APDU fields

Field name	Data type/Data description	m/o
infoExchangeContent	Actual content of the APDU For types and semantics, see further on in Clause 6	m
infoExchangeAuthenticator	Record (ASN.1 SEQUENCE) made of two fields: authenticatorEfc, and ackAuthenticatorEfc	o

Each infoExchangeContent field shall contain one Application Protocol Control Information (APCI) field and one ADUs field as specified in the InfoExchangeContent data type (see [Table 3](#)).

Any APDU (InfoExchange) may optionally be signed by calculating an **infoExchangeAuthenticator** over the **infoExchangeContents** field. The calculated authenticator shall be included as **infoExchangeAuthenticator** in the resulting APDU. Semantics of the two fields of the **infoExchangeAuthenticator**, as well as the algorithms used to calculate them, are specified in 7.3.

The **infoExchangeAuthenticator** is a dynamic object and shall be generated each time a new APDU is issued. The infoExchangeAuthenticator can be calculated by either the APDU originator or the information sender (see 6.2.2).

Table 3 indicates the fields in the InfoExchangeContent data type, which is defined in Annex A.

Table 3 — InfoExchangeContent data type fields

Field name	Data type/Data description	m/o
apci	Record (ASN.1 SEQUENCE) containing Protocol Control Information For a detailed description see 6.2.2	m
adus	Contains one or more Application Data Units of the same type, as a choice among requestAdus, ackAdus, trustObjectAdus, efcContextDataADUs, exceptionListADUs, reportAbnormalOBEADUs, tollDeclarationADUs, billingDetailsADU, paymentClaimADUs, reportQAADUs, statusADUs, reportCCCEventADUs, provideUserIdListADUs, paymentAnnouncementADUs and contractIssuerListADUs For detailed descriptions see Clause 6.3 to Clause 6.18	m

A top level view of the structure of InfoExchangeContent data type and its fields is given in Figure 4.

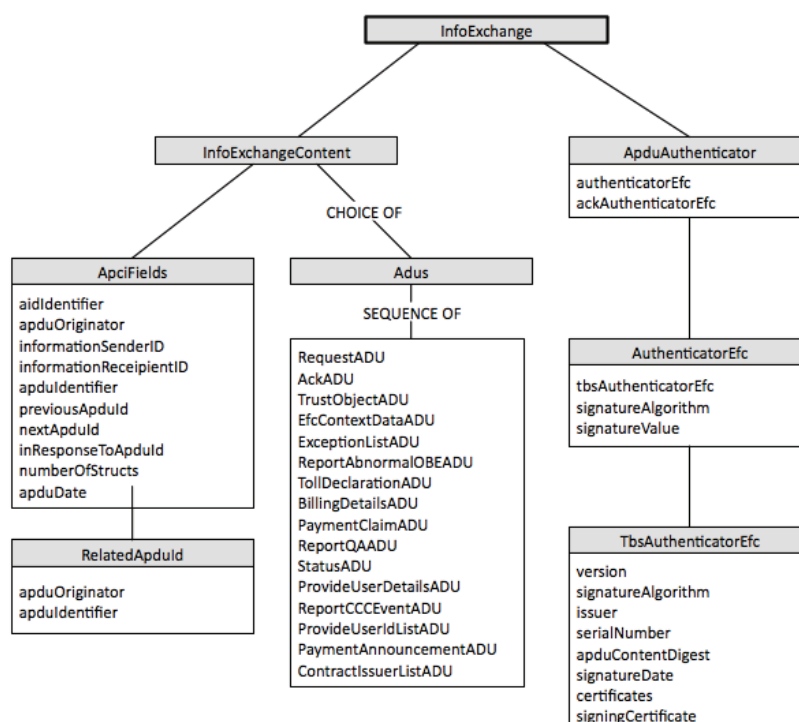


Figure 4 — InfoExchange data type structure

The clauses that follow describe the APCI and the ADUs for the defined APDUs.

APDUs are described in the following terms:

1. tables that list the parameters that make up the APDUs. For each table, the parameter names are listed, together with an indication of their fields and formats and whether the parameter is

mandatory (m) or optional (o). The parameter description is indicative and is formally specified in [Annex A](#). In cases where there are discrepancies, the formal definition in [Annex A](#) takes precedence;

2. additional semantics definition, and, given as text after each table, usage of each parameter.

6.2.2 Application Protocol Control Information

The APCI for all APDUs shall consist of the fields described in [Table 4](#).

Table 4 — APCI fields

Field name	Data type/Data description	m/o
aidIdentifier	INTEGER on two octets identifying the protocol version	m
apduOriginator	Entity identifier (ASN.1 Provider type) of the APDU contents generator	m
informationSenderId	Entity identifier (ASN.1 Provider type) of the APDU sender	m
informationRecipientID	Entity identifier (ASN.1 Provider type) of the APDU receiver	m
apduIdentifier	INTEGER that identifies this APDU	m
previousApduId	INTEGER that identifies a different APDU	o
nextApduId	INTEGER that identifies a different APDU	o
inResponseToApduId	INTEGER that identifies a different APDU	o
apduDate	Time stamp formatted as ASN.1 GeneralizedTime type	m

aidIdentifier shall identify the Protocol Version number. **aidIdentifier** = 0 shall be used to indicate this International Standard version.

apduOriginator shall be the identifier of the entity originating the contents of the APDU, and is an entity of type Toll Charger or Service Provider. That may or may not be the Information Sender.

informationSenderId shall identify the entity actually sending the APDU. It may be used to identify a technical entity supporting the apduOriginator in the task of transferring information. It may contain the same identifier as the **apduOriginator** field, when the originator and the sender are the same entity.

informationRecipientID shall be the identifier of the addressed entity responsible for processing the content of the APDU and is an entity of type Toll Charger or Service Provider. In some APDUs a null value is admitted for this field, with the meaning that the ADU(s) herein contained are intended for all possible recipients of the APDU.

apduIdentifier shall be a unique identifier for each given apduOriginator that is assigned by the apduOriginator. It is used to either acknowledge or request retransmission of a previously issued APDU.

previousApduId can optionally indicate that the APDU is related to a previously sent APDU from the apduOriginator. The field contains the identification of the APDU in terms of apduOriginator and apduIdentifier. This field, together with the nextApduId field, can be used to identify chains of APDUs.

nextApduId can optionally indicate that the APDU is related to a next to be sent APDU from the apduOriginator. The field contains the identification of the APDU in terms of apduOriginator and apduIdentifier. This field, together with the previousApduId field, can be used to identify chains of APDUs.

inResponseToApduId can optionally indicate that the APDU is either a response to a request or an ACK. It may be needed to identify a chain of APDUs to be processed in a workflow. The field contains the identification of the APDU in terms of apduOriginator and apduIdentifier.

apduDate shall specify a time stamp for the APDU.

6.2.3 Application Data Units

The Application Data Units (ADUs field) shall contain one or more data structures of the same type.

The ADUs listed in [Table 5](#) are defined in this International Standard.

Table 5 — ADUs overview

Functionality	ADU type name	Description
Basic	RequestADU	Generic request
	AckADU	Generic acknowledge
	StatusADU	Generic status
Exchange trust objects	TrustObjectADU	Send trust objects
Exchange EFC context data and contractual information	EfcContextDataADU	Send EFC context data
	ContractIssuerListADU	Provide contractual information on users
Manage exception lists	ExceptionListADU	Send exception list
	ReportAbnormalOBEADU	Report abnormal OBE
Report toll declarations	TollDeclarationADU	Toll declaration
Report billing details	BillingDetailsADU	Billing details
Payment settlement	PaymentClaimADU	Payment claim
	PaymentAnnouncementADU	Payment announcement
Exchange enforcement data	ProvideUserDetailsADU	Provide user details
	ReportCCCEventADU	Report CCC event
	ProvideUserIdListADU	Provide a user list
Exchange quality assurance parameters	ReportQAADU	Report QA

These data structures are specified in [6.3](#) to [6.18](#).

6.3 RequestADU data structure

The requestADU is made of one data structure of type RequestADU. It is used to indicate to the recipient of the request ADU the general readiness to receive, or the specific request to receive a specific data structure.

The RequestADU type is a choice (ASN.1 CHOICE) among different substructures, each one specifying a different type of request. [Table 6](#) describes the fields defined as CHOICE in a RequestADU data structure, which is formally defined in [Annex A](#).

Table 6 — RequestADU fields

Field name	Data type/Data description	m/o
genericRequest	Record (ASN.1 SEQUENCE) made of the following fields: requestedADUType, apduIdentifier, numberOfADUStruct (see description below Table 6)	N/A
exceptionListRequest	Record (ASN.1 SEQUENCE) made of the following fields: requestedADUType(exceptionListRequest), period, exceptionListType (see description below Table 6)	N/A
trustObjectRequest	Record (ASN.1 SEQUENCE) made of the following fields: requestedADUType(trustObject), requestedTrustObject (see description below Table 6)	N/A
tollDeclarationRequest	Record (ASN.1 SEQUENCE) made of the following fields: requestedADUType(TollDeclaration), userId, startTime, endTime (see description below Table 6)	N/A

Table 6 (continued)

Field name	Data type/Data description	m/o
userDetailsRequest	Record (ASN.1 SEQUENCE) made of the following fields: requestedADUType(userDetails), userId, listOfParametersRequested, userDetailsRequestReason, userInfoValidityPeriod (see description below Table 6)	N/A
cccEventRequest	Record (ASN.1 SEQUENCE) made of the following fields: requestedADUType(reportCCCEventADU), userId, startTime, endTime (see description below Table 6)	N/A
userListRequest	Record (ASN.1 SEQUENCE) made of the following fields: requestedADUType(provideUserIdListADU), userIdRequestType, userId, userIdRequestTime (see description below Table 6)	N/A

If the **genericRequest** is selected, the following rules apply:

1. all fields are optional. If no fields are specified, the RequestADU indicates a general readiness to receive;
2. if the **requestedADUType** field is specified, an ADU of the indicated data type is expected. It is used to indicate readiness to receive ADUs of the indicated type;
3. if the **requestedADUType** field is specified, the **apduIdentifier** may be specified;
4. if the **apduIdentifier** is specified, an ADU of the given type, which was previously transmitted in a APDU identified by the **apduIdentifier** field, is requested to be re-transmitted. If no **apduIdentifier** is specified, this ADU may be transferred to all possible recipients by specifying a null value in the **informationRecipientID** field of the APCI;
5. if the **apduIdentifier** field is specified, a **numberOfADUstructs** field may be specified. If a **numberOfADUstructs** field is specified as *n*, the request is to re-transmit a previously transmitted data structure of the same type and with the same identifier, containing only the *n*th instance.

If the **exceptionListRequest** is selected, the following rules apply:

1. **requestedADUType** field shall bear the value "exceptionListADU";
2. **period** field can optionally request to retransmit all ExceptionList ADUs that are related to the given period of time;
3. **exceptionListType** field can optionally request to retransmit all ExceptionList ADUs that are of the specified type.

If the **trustObjectRequest** is selected, the following rules apply:

1. **requestedADUType** field shall bear the value "trustObjectADU";
2. **requestedTrustObject** field shall either specify a trust object identifier, when an already issued trust object is requested to be resent, or indicate the type and, optionally, the purpose, of the required trust object. In case no specific trust object Type is to be requested, then a **genericRequest** shall be used, with the **requestedADUType** field bearing the value "trustObjectADU".

If the **tollDeclarationRequest** is selected, the following rules apply:

1. **requestedADUType** field shall bear the value "tollDeclarationADU";
2. **userId** field can optionally specify the UserId for which the toll declarations are requested. If it is not specified then the response shall include all toll declarations for all UserIds linked to the Service Provider;
3. **startTime** field can optionally specify a start of a period for which toll declarations are requested. If it is not specified then the response shall include all historic toll declarations;

4. **endTime** field can optionally specify the end of a period for which toll declarations are requested. If it is not specified then the response shall include all toll declarations up to the time the request ADU was generated;
5. if none of the optional fields is specified, then a **genericRequest** shall be used, with the **requestedADUType** field bearing the value "tollDeclarationADU".

If the **userDetailsRequest** is selected, the following rules apply:

1. **requestedADUType** field shall bear the value "provideUserDetailsADU";
2. **userId** field shall specify the UserId for which the additional details are requested;
3. **listOfParametersRequested** can optionally be used to specify which additional parameters, if any, are required. If this field is not specified then the response shall contain all available details;
4. **userDetailsRequestReason** can optionally be used to specify the reason for the request;
5. **userInfoValidityPeriod** can optionally be used to request user information related to the specified period in time, including cases where user information is varied during the period. If not specified, the currently available user information is meant to be requested.

If the **cccEventRequest** is selected, the following rules apply:

1. **requestedADUType** field shall bear the value "reportCCCEventADU";
2. **userId** field can optionally specify the UserId for which the CCC events are requested. If it is not specified then the response shall include all historic CCC events for all UserIds associated with the requesting Toll Service Provider;
3. **startTime** field can optionally specify a start of a period for which CCC events are requested. If it is not specified then the response shall include all historic CCC events for the specified UserId or for all UserIds associated with the requesting Toll Service Provider;
4. **endTime** field can optionally specify the end of a period for which CCC events are requested. If it is not specified then the response shall include all CCC events for the specified UserId or for all UserIds associated with the requesting Toll Service Provider up to the time the request ADU was generated.

If the **userListRequest** is selected, the Toll Charger is meant to request a Toll Service Provider to provide information on vehicles that belong to the same Service User. The following rules apply:

1. **requestedADUType** field shall bear the value "provideUserIdListADU";
2. **userIdRequestType** field shall provide the possibility to indicate the type of request. Currently, only one value is defined: allUserIdsToGivenCustomer;
3. **userId** field can optionally provide the identification of a vehicle or OBE that is known to the Toll Charger and where further vehicles or OBEs are requested that belong to the same Service User. If the field is not specified, the request is to retrieve details of all that TSP's users as filtered by **userIdRequestType**;
4. **userIdRequestTime** field can optionally provide the option to define a point of time. If this attribute is provided, the Toll Service Provider shall answer the request based on data valid at the provided point of time and not at the time of the request.

6.4 AckADU data structure

The ackADU is made of one data structure of the AckADU data type. The data structure is used to indicate that a specific data structure has been received. It can optionally indicate acceptance or rejection of the previously received data structure, or of the whole APDU that transported the data structure. When transferring this ADU, the value in the informationRecipientID field of the APCI shall identify a valid entity (a null value is not permitted).

[Table 7](#) describes the fields in an AckADU data structure, which is formally defined in [Annex A](#).

Table 7 — AckADU fields

Field name	Data type/Data description	m/o
apduIdentifier	INTEGER that identifies an APDU	m
explicitlyAkedAdus	Record made of fields of the same type (ASN.1 SEQUENCE OF), each one of type INTEGER, identifying an ADU in the acknowledged APDU	o
apduAckCode	INTEGER representing the ApduReasonCode	m
apduAckText	Additional textual information expressed as ASN.1 UTF8String type	o
issues	Series of records (ASN.1 SEQUENCE OF SEQUENCE), each record made of the following fields: issueADUStruct, issueLocation, issueContent, issueCode, issueText (see the description below)	o

apduIdentifier shall indicate the identifier of the APDU containing the data structure(s) being acknowledged.

explicitlyAkedAdus can optionally indicate the ADUs in the APDU being explicitly acknowledged. If explicitlyAkedAdus is not present, then the whole APDU is acknowledged together with all ADUs contained in it.

apduAckCode shall contain the status of the APDU or a reason for accepting or rejecting the APDU. The apduAckCode accepts or rejects an APDU as a whole. If an APDU is accepted, there can be additional responses on individual elements of the APDU (ADUs). A single ADU could be rejected while the APDU itself is accepted. This is dealt with by using the optional **issues** field (see below). If the **apduAckCode** indicates rejection, the whole APDU is rejected, irrespective of the possible acceptance codes indicated in the **issues** field.

apduAckText can optionally add a text to further explain the reason for accepting or rejecting the APDU.

EXAMPLE A number of data structures of the type BillingDetails have been transferred in a previous data exchange. The receiver of that data structure accepts one specific BillingDetails, and rejects all others. To do so, it issues an Ack ADU identifying the APDU that contains the BillingDetails data structures previously received, indicating for each of the rejected ADUs the reason for rejection. If all billing details are to be accepted, the acceptance of the APDU is sufficient.

issues can optionally provide detailed error information that responds to multiple instances of ADUs in the APDU being acknowledged. This allows the system to accept an APDU as a whole, but to possibly individually reject single ADUs. The only mandatory subfield in this structure is issueCode, which contains the reason code (see [Table 8](#)). The subfields issueLocation, issueContent and issueText are not further defined and can optionally be used based on bilateral negotiations.

Values of the AduReasonCode are reserved for CEN and ISO use. The values that are defined in this International Standard are listed (in decimal notation) in [Table 8](#) and are formally defined in [Annex A](#).

Table 8 — AduReasonCode values

Name	Meaning	Value
invalidADU	The specified ADU is invalid	0
notSupportedADU	The specified ADU is not supported	1
reserved	Codes reserved for trust object exchange errors	2..99
trustObjectExpired	The exchanged trust object is not more valid	100
trustObjectUnreadable	The received trust object is not readable	101