INTERNATIONAL STANDARD

ISO 17573-1

First edition
2019-07

Electronic fee collection — System architecture for vehicle-related tolling —

Part 1: Reference model

Perception électronique du télépéage — Architecture de systèmes pour le péage lié aux véhicules —

Partie 1: Modèle de référence

Reference number
ISO 17573-1:2019(E)

© ISO 2019



COPYRIGHT PROTECTED DOCUMENT

© ISO 2019

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

 © ISO 2019 – All rights reserved

Contents

Page

Foreword ..... **v**

Introduction ..... **vi**

1 Scope **1**

2 Normative references **1**

3 Terms and definitions **2**

4 Symbols and abbreviated terms **4**
4.1 Symbols 4
4.2 Abbreviated terms 4

5 The EFC community: roles and objectives **5**
5.1 General 5
5.2 Other ITS systems and services 6
5.3 Sensors, vehicle system and common equipment 6
5.4 Infrastructure sourced data 6
5.5 Financial/Commercial systems 6
5.6 Telecommunication systems 7
5.7 Jurisdiction/Authorities 7
5.8 Standardisation bodies 7
5.9 Common service rights provider 7

6 Roles internal to the EFC domain **8**
6.1 General 8
6.2 EFC domain roles 8
6.3 Interoperability manager 8
6.3.1 Short description 8
6.3.2 Responsibilities 9
6.4 Toll service provider 9
6.4.1 Short description 9
6.4.2 Responsibilities 9
6.5 User of the service 10
6.5.1 Short description 10
6.5.2 Responsibilities 10
6.6 Toll charger role 11
6.6.1 Short description 11
6.6.2 Responsibilities 11
6.7 EFC functional roles and responsibilities 12

7 Services **13**
7.1 Overview 13
7.2 Sub-services involving toll charger, toll service provider and interoperability manager roles 14
7.2.1 Adding or deleting a new toll charger 14
7.2.2 Adding or deleting a new toll service provider 16
7.2.3 Adding or modifying a toll regime 17
7.2.4 Defining rules 18
7.2.5 Monitoring operations 19
7.2.6 Handling disputes 20
7.3 Sub-services involving the toll service provider and user 21
7.3.1 Providing EFC contract 22
7.3.2 Providing customer care 24
7.3.3 User billing 25
7.4 Sub-services involving the toll charger and toll service provider 26
7.4.1 Collecting transit information in short-range communication systems 26
7.4.2 Collecting charging information (autonomous systems) 27
7.4.3 Collecting transit information (not OBE-based systems) 28

© ISO 2019 – All rights reserved

7.4.4 Providing payment information 28
7.4.5 Detecting Exceptions 30
7.4.6 Trust objects exchange 30
7.4.7 Handling exceptions 31
7.4.8 Providing local information 32
Annex A (informative) **Mapping EFC architecture to the C-ITS architecture** **34**
Annex B (informative) **Information schemata and basic information types** **37**
Annex C (informative) **Enterprise objects within roles** **43**
Bibliography **48**

© ISO 2019 – All rights reserved

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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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

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

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

This first edition of ISO 17573-1, cancels and replaces ISO 17573:2010, which has been technically revised.

The main changes compared to ISO 17573:2010 are as follows:

— update of the normative references, terms and definitions and abbreviated terms clauses and the Bibliography;

— relocation of previous Clause 8 (Information schemata and basic information types) to informative Annex B;

— removal of Clauses 9 (interfaces and computational objects) and 10 (Points of observation and view point correspondences), Annex A (Short Open Distributed Processing (ODP) description), Annex B (Comparison with ISO/TS 17573:2003), Annex C (Relations with this International Standard and IFMSA), Annex D (Relation with the European Electronic Tolls Service) and Annex E (Example of the Japanese electronic toll system);

— addition of the new informative Annex A (Mapping of the EFC architecture onto the C-ITS architecture) and Annex C (Enterprise objects within roles).

A list of all parts in the ISO 17573 series can be found on the ISO website.

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

© ISO 2019 – All rights reserved

Introduction

The widespread use of tolling also requires provisions for users of vehicles that are roaming through many different toll domains. Users should be offered a single contract for driving a vehicle through various toll domains and those vehicles require on-board equipment (OBE) that is interoperable with the toll systems in the various toll domains. In Europe, for example, this need has been recognised and legislation on interoperability has been adopted (Directive 2004/52).

In addition to specialised standards there is also a need for a system architecture that:

— provides an architectural "umbrella" for other EFC standards in terms of a common definition of terms and concepts, basic system functionalities, and structure;

— provides a common terminology which supports its users to improve the quality of specifications to be used in an international market,

  — to reduce the risk for conflicting interpretations of specifications (purchaser) and descriptions (supplier),

  — to simplify the communication between experts from different continents, and

  — to enhance the potential use of other EFC standards;

— defines a common framework, which enables both:

  — identification of potential activities subject to standardization, and

  — maintaining a common and consistent view of the whole area;

— defines the boundaries between the EFC and external domains;

— identifies all architectural objects that lay inside the EFC boundaries;

— provides a basic understanding of EFC, EFC interoperability, and the EFC services being offered.

Toll systems conforming to this document may be used for various purposes including measured distance toll, road segment toll, closed network toll, cordon toll, area toll, time-based toll and collecting fees for the use of bridges, tunnels, ferries, or for parking.

ISO 17573:2010 was based on a conceptual model defined in ISO/TR 14904 (withdrawn standard). Since then ideas on conceptual models have evolved in several regional projects and implementations, e.g. in Japan and Europe. Those new models have been detailed to a further extent compared to ISO 17573:2010 and are closer to real life implementations. This document is based on these new conceptual models and uses the associated terms and definitions.

Although there are many differences, collecting a toll for vehicles can, to some extent, be compared with collecting a fare for public transport. Architectural harmonisation of the collection of fee and fare may be desirable from a policy and from a user point of view. In the past, ISO 24014-1 prepared by ISO TC 204 used ISO 17573:2010 as a starting point. This document has benefited from that and has also taken ISO 24014-1 into account.

In this document, the Open Distributed Processing (ODP) standard is used for the description of the architecture.

The ODP standard gives a vocabulary and modelling tools to see the architecture of a system from different perspectives (the viewpoints), in order to cover, e.g. hardware components as well as network protocols or interfaces or roles and general policies of the system itself. This is accomplished using different sets of concepts and terminologies, each one of those expressed as a viewpoint language. A complete description of a real system can only be achieved when all viewpoint models are designed. This allows for a clear separation of concerns and an easier way to define a system.

 © ISO 2019 – All rights reserved

In more recent years, the development of concepts and standards in the field of Cooperative ITS (C-ITS, ISO TC 204 and CEN TC 278) led to the definition of a general enterprise viewpoint architecture for C-ITS (ISO 17427-1) that, by following the same approach of using the ODP architecture to model a complex system, defined concepts and terms for the more general realm of C-ITS.

This document gives a description of the architecture of the toll systems environment from the enterprise viewpoint, by refining and extending what had been already done in ISO 17573:2010. Correspondences between concepts and terms in this document and those in ISO 17427-1 are shown in Annex A. In addition, this document gives in Annex B the foundations of the information viewpoint by identifying information interactions and general information objects. With respect to ISO 17573:2010, this document removes all security requirements on interfaces, which are better and more generally dealt with in ISO 19299.

This document is Part 1 of a multipart standard that is made up of the following parts:

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

— ISO/TR 17573-2[1)], *Electronic fee collection — System architecture for vehicle related tolling — Part 2: Terminology*

1) Under development. Current stage: 30.99

© ISO 2019 – All rights reserved

Electronic fee collection — System architecture for vehicle-related tolling —

Part 1: Reference model

1 Scope

This document defines the architecture of electronic fee collection (EFC) system environments, in which a customer with one contract may use a vehicle in a variety of toll domains with a different toll charger for each domain.

EFC systems conforming to this document can be used for various purposes including road (network) tolling, area tolling, collecting fees for the usage of bridges, tunnels, ferries, for access or for parking. From a technical point of view the considered toll systems may identify vehicles subject to tolling by means of electronic equipment on-board in a vehicle or by other means (e.g. automatic number plate recognition, ANPR).

From a process point of view the architectural description focuses on toll determination, toll charging, and the associated enforcement measures. The actual collection of the toll, i.e. collecting payments, is outside of the scope of this document.

The architecture in this document is defined with no more details than required for an overall overview, a common language, an identification of the need for and interactions among other standards, and the drafting of these standards.

This document as a whole provides:

— the enterprise view on the architecture, which is concerned with the purpose, scope and policies governing the activities of the specified system within the organization of which it is a part;

— the terms and definitions for common use in an EFC environment;

— a decomposition of the EFC systems environment into its main enterprise objects;

— the roles and responsibilities of the main actors. This document does not impose that all roles perform all indicated responsibilities. It should also be clear that the responsibilities of a role may be shared between two or more actors. Mandating the performance of certain responsibilities is the task of standards derived from this architecture;

— identification of the provided services by means of action diagrams that underline the needed standardised exchanges;

— identification of the interoperability interfaces for EFC systems, in specialised standards (specified or to be specified).

2 Normative references

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

ISO/IEC 7498-1:1994, *Information technology — Open Systems Interconnection — Basic Reference Model: The Basic Model — Part 1*

© ISO 2019 – All rights reserved

ISO/IEC 10746-2, *Information technology — Open distributed processing — Reference model: Foundations — Part 2*

ISO/IEC 10746-3, *Information technology — Open distributed processing — Reference model: Architecture — Part 3*

ISO 14813-5, *Transport information and control systems — Reference model architecture(s) for the TICS sector — Part 5: Requirements for architecture description in TICS standard*

ISO/IEC 15414, *Information technology — Open distributed processing — Reference model — Enterprise language*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 7498-1:1994, ISO/IEC 10746-2, ISO/IEC 10746-3, ISO 14813-5 and ISO/IEC 15414, and the following apply.

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

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

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

3.1
automatic number plate recognition
technology that uses optical character recognition on images to read vehicle registration plates

3.2
artefact
physical object of material or physical piece of information or a system or subsystem that is used in an ITS system

3.3
billing detail
information needed to determine or verify the amount due for the usage of a given service

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

3.5
electronic fee collection
fee collection by electronic means

Note 1 to entry: The actual payment (collection of the fee) may take place outside the toll system.

3.6
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.

3.7
interoperability
ability of systems to exchange information and to make mutual use of the information that has been exchanged

EXAMPLE Tolling interoperability aims at enabling a vehicle to drive through various toll domains while having only one OBE operating under one contract with a toll service provider.

© ISO 2019 – All rights reserved

3.8
localisation augmentation
information sent by the roadside equipment to the on-board equipment to augment the positioning for autonomous systems

3.9
on-board equipment
all required equipment on-board a vehicle for performing required electronic fee collection (EFC) functions and communication services

3.10
roadside equipment
equipment located along the road, either fixed or mobile

3.11
role
set of responsibilities

3.12
short-range communication
tolling technique based on transfer of information via a radio connection between a roadside equipment and an on-board equipment

Note 1 to entry: This includes 5,8 GHz DSRC as well as ITS-G5 and RFID.

3.13
tariff scheme
set of rules to determine the fee due for a vehicle within a toll domain

3.14
toll
charge, tax or duty levied in connection to using a vehicle in a toll domain

3.15
Toll Charger
entity which levies a toll for the use of vehicles in a toll domain

3.16
toll declaration
statement to declare the usage of a given toll service to a toll charger

3.17
toll domain
area or part of a road network where a certain toll regime is applied

3.18
toll regime
set of rules, including enforcement rules, governing the collection of a toll in a toll domain

3.19
toll scheme
organizational view of a toll regime, including the actors and their relationships

3.20
toll service
service enabling users to pay a toll

3.21
Toll Service Provider
entity providing toll services in one or more toll domains

© ISO 2019 – All rights reserved

3.22
transport service
transport infrastructure related service which is offered to the user

3.23
trust object
information object that is exchanged between entities to ensure mutual trust

EXAMPLE Electronic signature or an electronic certificate.

4 Symbols and abbreviated terms

4.1 Symbols

In action diagrams, the following graphical conventions apply:



Rounded corner boxes indicate responsibilities and related activities within roles



Arrows crossing borders between roles indicate information exchanges between roles as activities performed within responsibilities



Vertical arrows within activities represent execution steps



Solid circles represent start of activities



Partially coloured circles represent end of activities



Solid horizontal bars represent decision gates

4.2 Abbreviated terms

For the purpose of this document, the following abbreviated terms apply throughout the document unless otherwise specified.

ANPR Automatic Number Plate Recognition

CE Central Equipment

C-ITS Cooperative ITS

DSRC Dedicated Short-Range Communication

EETS European Electronic Toll Service

EFC Electronic Fee Collection

GNSS Global Navigation Satellite Systems

© ISO 2019 – All rights reserved