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Public transport — Interoperable fare management system —

Part 1: Architecture

Transport public — Système de gestion tarifaire interopérable —

Partie 1: Architecture

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Foreword

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

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

This document was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 278, *Intelligent transport systems*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This third edition cancels and replaces the second edition (ISO 24014-1:2015), which has been technically revised.

The main changes compared to the previous edition are as follows:

— in order to prepare compatibility of Interoperable Fare Management (IFM) systems with mobility platforms encompassing the entire mobility service chain, functions and roles known from IFM are expanded; and

— new roles are introduced to operate mobility platforms.

A list of all parts in the ISO 24014 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.

Introduction

Fare management (FM) encompasses all the processes designed to manage the distribution and use of fare products in a public transport environment.

Fare management is called interoperable (IFM) when it enables the customer to use a portable electronic medium (e.g. a contact/contactless smart card or a Near Field Communications mobile device) with compatible equipment (e.g. at stops, with retail systems, at platform entry points or on board vehicles). IFM concepts can also be applied to fare management systems not using electronic media.

Potential benefits for the customer include reductions in queuing, special and combined fares, one medium for multiple applications, loyalty programmes and seamless journeys.

There are two main changes in this edition of this document compared to the previous edition. Firstly, in order to prepare compatibility of IFM systems with mobility platforms encompassing the entire mobility service chain, functions and roles known from IFM are expanded. Secondly, new roles are introduced to operate mobility platforms. These new roles should act with the roles defined in the IFM and enter into interface relations.

With the introduction of so-called mobility platforms, which can integrate various IFM systems and additional modes of transportation and deliver the travel information across these integrated domains, the customer can benefit from seamless and well-guided multi- or inter-modal travel.

Interoperability of fare management systems also provides benefits to operators and the other parties involved. However, it requires an overall system architecture that defines the system functionalities, the actors involved and their roles, the relationships and the interfaces between them.

Interoperability also requires the definition of a security scheme to protect privacy, integrity, and confidentiality between the actors to ensure fair and secure data flow within the IFM system (IFMS). The overall architecture is the subject of this document, which recognizes the need for legal and commercial agreements between members of an IFMS, but does not specify their form. The technical specifications of the component parts and, particularly, the standards for customer media (e.g. smart cards) are not included.

Note that there is not one single IFMS. Individual operators, consortia of operators, public authorities, and private companies can manage and/or participate in IFMSs. An IFMS can span country boundaries and can be combined with other IFMSs. Implementations of IFMSs require security and registration functionalities. This document allows for the distribution of these functions to enable the coordination/convergence of existing IFMSs to work together.

This document intends to provide the following benefits:

a) It defines a common definition of terms and roles that shall constitute the basis for the other parts of ISO 24014 and technical specifications and technical reports from ISO/TC 204 which address mobility platforms, fare management and interoperability between IFM and other systems.

b) It provides a framework for an interoperable fare management implementation with minimum complexity.

c) It provides guidance on how IFM Managers can benefit from external devices and services and how interoperability and appropriate security level can be established in cooperation with systems from other markets.

d) It aims to shorten the time and lower the cost of IFMS procurement as both suppliers and purchasers understand what is being purchased. Procurement against an open standard reduces cost as it avoids the need for expensive bespoke system development and provides for second sourcing.

e) It aims to simplify interoperability between IFMSs to the benefit of all stakeholders.

In Annex A, this document provides a framework for mobility platforms that integrate fare management and travel information for inter- and multimodal travel. This document also contains other informative

annexes, which elaborate on some specific subjects of the document and offer some national examples with regard to IFMS implementations (see Annex B, Annex C, Annex D and Annex E).

Public transport — Interoperable fare management system —

Part 1: Architecture

1 Scope

This document gives guidelines for the development of multi-operator/multi-service interoperable public surface (including subways) transport fare management systems (IFMSs) on a national and international level.

This document is applicable to bodies in public transport and related services which agree that their systems need to interoperate.

This document defines a conceptual framework which is independent of organizational and physical implementation. Any reference within this document to organizational or physical implementation is purely informative.

This document defines a reference functional architecture for IFMSs and establishes the requirements that are relevant for ensuring interoperability between several actors in the context of the use of electronic tickets.

The IFMS includes all the functions involved in the fare management process, such as:

— management of media,

— management of applications,

— management of products,

— security management, and

— certification, registration, and identification.

This document defines the following main elements:

— identification of the different sets of functions in relation to the overall IFMS and services and media from non-transport systems which interact with fare management systems;

— a generic model of an IFMS describing the logical and functional architecture and the interfaces within the system, with other IFMSs and with services and media from non-transport systems;

— use cases describing the interactions and data flows between the different sets of functions;

— security requirements.

In its annexes, this document provides a framework for mobility platforms that integrate fare management and travel information for inter- and multimodal travel (see Annex A). It also elaborates on specific subjects covered in document and offers some national examples with regard to IFMS implementations (see Annex B, Annex C, Annex D and Annex E).

This document does not define:

— the technical aspects of the interface between the medium and the medium access device;

— the data exchanges between the medium and the medium access device;

NOTE The data exchanges between the medium and the medium access device are proposed by other standardization committees.

— the financial aspects of fare management systems (e.g. customer payments, method of payment, settlement, apportionment, reconciliation).

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

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

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

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

3.1
account-based ticketing
ABT
architectural approach that stores *products* (3.30) in the *IFM* (3.19) system's back-office (i.e. the customer's personal account or a temporary account) and not in the *customer medium* (3.12)

Note 1 to entry: The customer medium carries authentication credentials and an *application* (3.7) that contains references to the account-based products in the back-office.

3.2
action list
list of items related to *IFM* (3.19) *applications* (3.7) or *products* (3.30) downloaded to *medium access devices* (3.24) (MADs) processed by the MAD if and when a specific IFM application or product referenced in the list is encountered by that MAD

3.3
actor
person, *organization* (3.25), or another (sub)system playing a coherent set of functions when interacting with the *IFM system* (3.20) within a particular *use case* (3.36)

3.4
application rules
specification of rules in the *application* (3.7) contract for the use of the application with the Customer as defined by the application owner

3.5
application specification
specification of functions, data elements, and security scheme according to the *application rules* (3.4)

3.6
application template
executable technical pattern of the *application specification* (3.5)

3.7
application
implemented and initialized *application template* (3.6)

Note 1 to entry: The application may host one or more *products* (3.30) and may support functions which identify and protect the access to these products. For ABT- and ID-based architectures, the application may reside partly in the *customer medium* (3.12) (identification and access control function) and partly in the *IFM* (3.19) back-office (products).

Note 2 to entry: The application is identified by a unique identifier.

Note 3 to entry: The application may house *products* (3.30) and other optional customer information (customer details, customer preferences).

Note 4 to entry: The application can be fully installed on customer media or distributed on the customer media and the IFM back-offices.

3.8
commercial rules
rules defining the settlement and commission within the *IFMS* (3.20)

3.9
component
any piece of hardware and/or software that performs one or more functions in the *IFMS* (3.20)

3.10
component provider
anyone who wants to bring a *component* (3.9) to the *IFMS* (3.20)

3.11
customer account
data space hosted by the *IFMS* (3.20) (typically the product retailer) that contains all information which is relevant for the business relationship between the Customer and the IFMS

Note 1 to entry: Accounts are maintained and managed by the responsible stakeholder in the IFMS. Accounts which are accessible online may also be established and managed by the Customer.

3.12
customer medium
medium (3.22) initialized with an *application* (3.7) through an application contract

3.13
derived identity
derived ID
electronic identifier generated from another *ID* (3.15) (primary ID)

Note 1 to entry: Typically, the derived ID is generated by an identity provider in such a way that the authenticity of the derived ID can be proven but there is no way to conclude from the derived ID back to the primary ID. The concept of derived ID is typically used when primary ID with high security demand (like driver licence or governmental eID) shall not be exposed to an environment that doesn't support high assurance levels.

3.14
external
object which does not follow the rules of the *IFMS* (3.20) and for which special activities are necessary to implement interoperability and security with the IFMS

3.15
identity
ID
information that describes a specific person or object in a unique and unambiguous way

Note 1 to entry: For instance, a person can be described by the attributes name, birth date, sex, address, etc. Unambiguous identification of a person typically needs, in addition, a unique identifier which is issued by the Identity Provider. An object, e.g. a ticketing machine, can be described by owner, type, and software version. A unique serial number could serve as identifier.

3.16
IFM functional model
model to define functions of *IFM roles* (3.18) and how they interact

3.17
IFM policy
commercial, technical, security, and privacy objectives of *IFM* (3.19)

3.18
IFM role
abstract object performing a set of functions in an *IFM functional model* (3.16)

3.19
interoperable fare management
IFM
all the functions involved in the fare management process such as management of *application* (3.7), *products* (3.30), security and certification, registration, and identification to enable Customers to travel with participating Service Operators using a single portable electronic *medium* (3.22)

3.20
interoperable fare management system
IFMS
all technical, commercial, security, and legal elements which enable *interoperable fare management* (3.19)

3.21
level of assurance
LoA
level of resilience of *IFMS* (3.20) *components* (3.9) and processes against a defined attack potential

Note 1 to entry: to entry; Level of assurance is typically defined by the Security Manager for all components of the IFMS and specified in the *set of rules* (3.33) for security certification.

3.22
medium
physical carrier of *applications* (3.7)

3.23
message
set of data elements transferred between two *IFM roles* (3.18)

3.24
medium access device
MAD
device with the necessary facilities (hardware and software) to communicate with a *customer medium* (3.12)

3.25
organization
legal entity covering the functions and implied responsibilities of one or more of the following operational *IFM roles* (3.18): Application Owner, Application Retailer, Product Owner, Product Retailer, Service Operator, Collection and Forwarding, etc.

3.26
pricing rule
rules defining the price and payment/billing relationships to the Customer

3.27
product rule
usage, pricing, and *commercial rules* (3.8) defined by the Product Owner

3.28
product specification
complete specification of functions, data elements, and security scheme according to the *product rules* (3.27)

3.29
product template
technical pattern of the *product specification* (3.28)

Note 1 to entry: The product template is identified by a unique identifier.

3.30
product
instance of a *product template* (3.29) stored in an *application* (3.7)

Note 1 to entry: A product defines a commercial offer to the Customer. By purchasing a product, the Customer is entitled to obtain specific services which are defined by the Product Owner.

Note 2 to entry: It is identified by a unique identifier and enables the Customer to benefit from a service provided by a Service Operator.

3.31
role
abstract object performing a set of functions

3.32
security policy
objectives of the *IFMS* (3.20) to secure the public interests and the assets within the IFMS

3.33
set of rules
regulations for achieving *IFM policies* (3.17) expressed as technical, commercial, security, and legal requirements and standards relevant only to the IFMS

3.34
trigger
event that causes the execution of a *use case* (3.36)

3.35
usage rule
rule defining the usage time, the usage area, the personal status and the type of service

3.36
use case
description of a process by defining a sequence of actions performed by one or more *actors* (3.3) and by the system itself

4 Abbreviated terms

KYC know your customer

NFC near field communication

PAYG pay-as-you-go

PT public transport

5 Requirements

The purpose of the ISO 24014 series is to achieve interoperability throughout fare management systems while making sure that participating companies in PT remain as commercially free as possible to design their own implementation in pursuing their own business strategies.

In addition, interoperability between individual IFMS, with external systems and services and also the integration of IFMS by so-called mobility platforms shall be specified.

Specific requirements of the IFMS model are as follows:

— A Customer shall be able to travel with all participating Service Operators (seamless journey) using a single medium.

— There shall be a capability to extract data appropriate to the revenue-sharing and statistical requirements of the Service Operators.

— The same medium may carry additional applications in addition to the IFM application. Conversely, external media may carry the IFM application.

— The methods associated with the application shall offer the opportunity to reduce the current time taken to enter/exit the PT system and may reduce payment handling costs significantly.

— The IFMS model shall provide the capability to accommodate new product specifications as required regardless of those already in existence.

— The IFMS model shall recognize and prevent internal or external fraud attacks.

— The IFMS model shall facilitate a balance between measures for security and fraud avoidance against the need to offer Customer convenience and performance.

— The IFMS model shall have the capability to identify the Customer while protecting their privacy as appropriate.

— The IFMS model shall ensure the integrity of exchanged data.

— The IFMS model shall enable the implementation of additional services: loyalty programmes, car sharing, park and ride, bike and ride, etc.

— The IFMS model shall provide interface definitions between identified functions within PT or other modes of transportation to enable different operator networks to interoperate.

— The IFMS model shall describe interfaces which are essential to enable data-forwarding functions between different operator networks allowing revenue-sharing agreements to be met.

— The IFMS model shall provide a framework from which commercial agreements may be developed.

— The IFMS model shall be neutral with regard to different technologies which can be deployed [e.g. contact medium, contactless medium (short range, wide range), external devices, independent of access technologies, account-, cloud- or ID-based concepts].

— The IFMS model shall be functionally neutral regarding specific transport organization structures.

— The IFMS model shall support the introduction of and migration to new technologies and architecture concepts and interoperability with media, applications and systems from other market sectors.

6 System environment for IFMS

6.1 General

Previous editions of this document have focused on interoperability between fare management systems. However, recent trends and market developments require enhancements of the IFMS architecture, interoperability with other PT systems and also interoperability with systems, customer media and applications from other market sectors. This system environment for IFMS is illustrated in Figure 1 below.

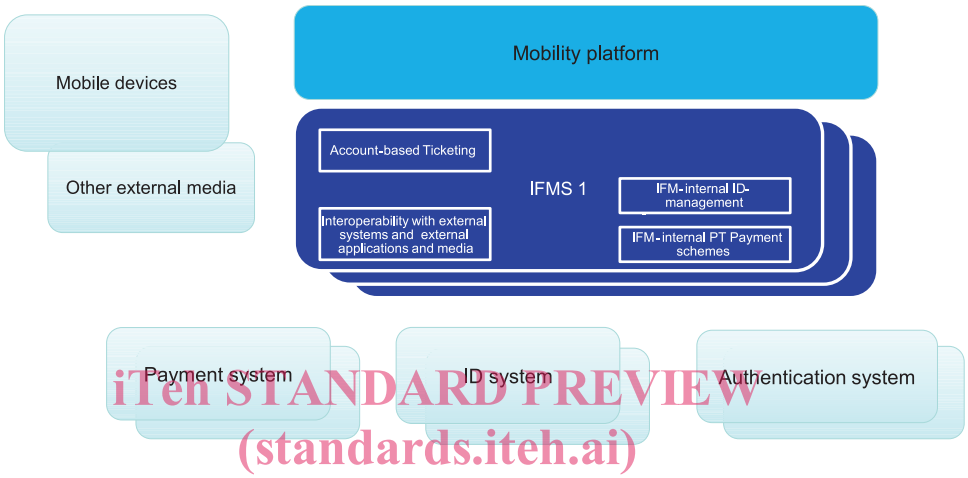

Figure 1 — System environment for IFMS

6.2 Mobility platforms

The approaches mentioned so far are primarily related to IFMS. However, advanced travel information systems and complex mobility platforms offer functionalities encompassing the entire service chain, of which fare management is only a part. For the comprehensive modelling of the roles in the context of travel information systems and their interdependencies, extensions are needed on the travel information side.

In order to integrate IFMSs in mobility platforms, functions and roles known from IFM should be expanded. In addition, new roles are required to operate mobility platforms. These new roles should act with the roles defined in the IFM and enter into interface relations.

This document defines a possible approach to mobility platforms in Annex A.

7 Conceptual framework for IFMS

7.1 General

The IFMS may be operated by a single transport undertaking, a transport authority, an association of public and private companies, or other groups.

An IFM Manager establishes and manages the IFM policies on behalf of the IFMS. These policies are embedded in the set of rules.

To manage the elements of the IFMS dealt with in this document, the IFM Manager shall appoint:

— Security Manager, and