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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

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

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 document 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](http://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 and IEC 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](http://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 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*.

ISO 24014-1 was prepared by European Committee for Standardization (CEN) Technical Committee CEN/TC 278 *Road transport and traffic telematics*, in collaboration with ISO/TC 204, *Intelligent transport systems*, in accordance with the agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 24014-1:2007), which has been technically revised.

ISO 24014 consists of the following parts, under the general title *Public transport — Interoperable fare management system*:

- *Part 1: Architecture*
- *Part 2: Business practices*
- *Part 3: Complementary concepts to Part 1 for multi-application media*

## 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) 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.

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 part of ISO 24014 which recognizes the need for legal and commercial agreements between members of an IFM, 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 IFM. Individual operators, consortia of operators, public authorities, and private companies can manage and/or participate in IFMSs. An IFM can span country boundaries and can be combined with other IFMSs. Implementations of IFMSs require security and registration functionalities. This part of ISO 24014 allows for the distribution of these functions to enable the coordination/convergence of existing IFMSs to work together.

This part of ISO 24014 intends to provide three main benefits:

- a) It provides a framework for an interoperable fare management implementation with minimum complexity.
- b) It aims to shorten the time and lower the cost of IFM 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.
- c) It aims to simplify interoperability between IFMSs to the benefit of all stakeholders.

The work has benefited from the architecture work done in Electronic Fee Collection (CEN/TC 278/WG 1) and other domains including the following:

- ISO/TS 14904, *Road transport and traffic telematics — Electronic fee collection (EFC) — Interface specification for clearing between operators*;
- ISO/TS 17573, *Electronic fee collection — Systems architecture for vehicle-related tolling*;
- existing international data security standards.

# Public transport — Interoperable fare management system —

## Part 1: Architecture

### 1 Scope

This part of ISO 24014 provides the basis 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 part of ISO 24014 is applicable to bodies in public transport and related services which agree that their systems need to interoperate.

While this part of ISO 24014 does not imply that existing interoperable fare management systems need to be changed, it applies so far as it is practically possible to extensions of these.

This part of ISO 24014 covers the definition of a conceptual framework which is independent of organisational and physical implementation. Any reference within this part of ISO 24014 to organisational or physical implementation is purely informative.

The objective of this part of ISO 24014 is to define a reference functional architecture for IFMSs and to identify the requirements that are relevant to ensure 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 application,
- management of products,
- security management, and
- certification, registration, and identification.

This part of ISO 24014 defines the following main elements:

- identification of the different set of functions in relation to the overall fare management system;
- a generic model of IFMS describing the logical and functional architecture and the interfaces within the system and with other IFMSs;
- use cases describing the interactions and data flows between the different set of functions;
- security requirements.

This part of ISO 24014 excludes consideration of the following:

- the physical medium and its management;
- 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 Terms and definitions

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

### 2.1 action list

list of items related to IFM applications or *products* (2.24) downloaded to *medium access devices* (2.18) (MADs) processed by the MAD if and when a specific IFM application or product referenced in the list is encountered by that MAD

### 2.2 actor

person, an *organisation* (2.19), or another (sub)system playing a coherent set of functions when interacting with the IFM system within a particular *use case* (2.30)

### 2.3 application rules

application owner requirements

### 2.4 application specification

specification of functions, data elements, and security scheme according to the *application rules* (2.3)

### 2.5 application template

executable technical pattern of the *application specification* (2.4)

### 2.6 application

implemented and initialised *application template* (2.5)

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

Note 2 to entry: The application houses *products* (2.24) and other optional customer information (customer details, customer preferences).

Note 3 to entry: The application can be fully installed on a customer media or distributed on the customer media and the IFM back offices.

### 2.7 commercial rules

rules defining the settlement and commission within the IFMS

### 2.8 component

any piece of hardware and/or software that performs one or more functions in the IFMS

### 2.9 component provider

anyone who wants to bring a *component* (2.8) to the IFMS

### 2.10 IFM functional model

model to define functions of *IFM-roles* (2.12) and how they interact

### 2.11 IFM policies

commercial, technical, security, and privacy objectives of IFM



**2.12****IFM-role**

abstract object performing a set of functions in an *IFM functional model* (2.10)

**2.13****interoperable fare management****IFM**

all the functions involved in the fare management process such as management of application, *products* (2.24), security and certification, registration, and identification to enable customers to travel with participating service operators using a single portable electronic medium

**2.14****interoperable fare management system****IFMS**

all technical, commercial, security, and legal elements which enable an *interoperable fare management* (2.13)

**2.15****medium**

physical carrier of *applications* (2.6)

**2.16****message**

set of data elements transferred between two *IFM-roles* (2.12)

**2.17****customer medium**

*medium* (2.15) initialised with an *application* (2.6) through an application contract

**2.18****medium access device****MAD**

device with the necessary facilities (hardware and software) to communicate with a *customer medium* (2.17)

**2.19****organisation**

legal entity covering the functions and implied responsibilities of one or more of the following operational *IFM-roles* (2.12): application owner, application retailer, product owner, product retailer, service operator, and collection and forwarding

**2.20****pricing rules**

rules defining the price and payment/billing relationships to the customer

**2.21****product rules**

set of usage, pricing, and *commercial rules* (2.7) defined by the product owner

**2.22****product specification**

complete specification of functions, data elements, and security scheme according to the *product rules* (2.21)

**2.23****product template**

technical pattern of the *product specification* (2.22)

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

**2.24**

**product**

instance of a *product template* (2.23) stored in an *application* (2.6)

Note 1 to entry: It is identified by a unique identifier and enables the customer to benefit from a service provided by a service operator.

**2.25**

**role**

abstract object performing a set of functions

**2.26**

**security policy**

objectives of the IFM to secure the public interests and the assets within the IFM

**2.27**

**set of rules**

regulations for achieving *IFM policies* (2.11) expressed as technical, commercial, security, and legal requirements and standards relevant only to the IFMS

**2.28**

**trigger**

event that causes the execution of a *use case* (2.30)

**2.29**

**usage rules**

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

**2.30**

**use case**

description of a process by defining a sequence of actions performed by one or more *actors* (2.2) and by the system itself

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**3 Abbreviated terms**

IFM	Interoperable Fare Management
IFMS	Interoperable Fare Management system
MAD	Medium Access Device
PP	Protection Profile
PT	Public Transport
SSS	Security SubSystem
TOE	Target Of Evaluation

**4 Requirements**

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

Specific requirements of the IFMS model are as follows.

- A customer shall be able to travel with all participating operators (the seamless journey) using a single medium.

- There shall be a capability to extract data appropriate to the revenue-sharing and statistical requirements of the transport operators.
- The same medium may carry additional applications. Conversely, other media may carry the IFM application.
- The ticketing methods associated with the application shall offer the opportunity to reduce the current time taken to enter/exit the public transport system and may reduce payment handling costs significantly.
- The IFMS model shall comply with data protection and financial services laws/regulations (e.g. privacy).
- 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 identify the customer while protecting their privacy as appropriate.
- The IFMS model shall protect the privacy of the customer.
- 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 public transport 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), independent of access technologies].
- The IFMS model shall be functionally neutral regarding specific transport organization structures.

## 5 Conceptual framework

The IFMS may be run 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 part of ISO 24014, the IFM manager shall appoint

- a security manager, and
- a registrar.

The functions and the responsibilities of the security manager and the registrar can be distributed to several organisations within an IFM. This may be a necessary condition to allow the cooperation of existing IFMSs. An example is shown in B.3. The example also shows how a new common set of rules for the joint IFMS is built upon the existing sets of the cooperating IFMSs.

## 5.1 Description of IFM-roles

IFM-roles are identified by capitalized initial letters.

Product Owner	<p>The Product Owner is responsible for his Products.</p> <p><b>Functions of ownership:</b></p> <ul style="list-style-type: none"><li>— Specifying pricing, Usage Rules, and Commercial Rules.</li></ul> <p><b>Functions of clearing:</b></p> <ul style="list-style-type: none"><li>— Trip reconstruction</li><li>— Product aggregation based on received usage data using Product definition rules;</li><li>— Linking of aggregated usage data with acquisition data;</li><li>— Preparation of apportionment data based on Product Specification.</li></ul> <p><b>Functions of reporting:</b></p> <ul style="list-style-type: none"><li>— Detailed:<ul style="list-style-type: none"><li>— acquisition data with no link to usage data within the reporting period;</li><li>— usage data with no link to acquisition data within the reporting period;</li><li>— linked aggregated Product data within the reporting period.</li></ul></li><li>— Summary:<ul style="list-style-type: none"><li>— apportionment data and clearing report.</li><li>— Total acquisition data.</li></ul></li></ul>
Product Retailer	<p>The Product Retailer sells and terminates Products, collects, and refunds value to a customer as authorized by a Product Owner.</p> <p>The Product Retailer is the only financial interface between the customer and the IFMS related to Products.</p>
Application Retailer	<p>The Application Retailer sells and terminates Applications, collects, and refunds value to a customer as authorized by an Application Owner.</p> <p>The Application Retailer is the only financial interface between the customer and the IFMS related to Applications.</p>
Collection and Forwarding	<p>The IFM-role of Collection and Forwarding is the facilitation of data interchanges of the IFMS. The general functions are data collection and forwarding. They contain at least the following functions:</p>

**Functions of collecting**

- Receiving Application Template from Application Owner.
- Receiving Product Template from Product Owner.
- Receiving data from Service Operators.
- Receiving data from Product Retailer.
- Receiving data from Application Retailer.
- Receiving data from other Collection and Forwarding functions.
- Receiving security list data from Security Manager.
- Receiving clearing reports from Product Owner.
- Consistency and completeness check of the data collected on a technical level.
- Receiving the address list of all IFM-roles in the IFM from the Registrar.

**Functions of forwarding**

- Forwarding “Not On Us” data to other Collection and Forwarding functions.
- Recording “Not On Us” data.
- Forwarding data with a corrupt destination address to the Security Manager.
- Forwarding “On Us” data to the Product Owner for clearing and reporting.
- Forwarding clearing reports, Application Template, Product Template, and security list data to the Product Retailer and Service Operator.
- Forwarding Application Templates and security list data to the Application Retailer and Service Operator.

NOTE The “ON US and NOT ON US” concept is as follows.

- A specific Collection and Forwarding function is to collect data from one IFM-role and forward it to other IFM-roles.
- Logically, there may be several COLLECTION AND FORWARDING functions within the IFM.
- IFM-roles may be linked to different COLLECTION AND FORWARDING functions, but each IFM-role can only be linked to one.
- The concept of “ON US and NOT ON US” addresses this connectivity functionality: Data held by a specific COLLECTION AND FORWARDING function is either “ON US” or “NOT ON US” data.
- Data collected by a specific COLLECTION AND FORWARDING function addressed to IFM-roles directly linked to this COLLECTION AND FORWARDING function is termed “ON US” data.
- Data collected by a specific COLLECTION AND FORWARDING function addressed to IFM-roles not linked to this COLLECTION AND FORWARDING function is termed “NOT ON US” data.

Service Operator	The Service Operator provides a service to the customer against the use of a Product.
Application Owner	The Application Owner holds the Application contract for the use of the Application with the customer.

Customer Service	Subject to commercial agreements, Customer Service may provide “helpline” and any similar facilities including replacement of stolen and damaged Customer Medium and consequent Product reinstalling.
Customer	The Customer holds an Application and acquires Products in order to use the public transport services.
Security Manager	The Security Manager is responsible for establishing and coordinating the Security Policy and for <ul style="list-style-type: none"> <li>— certification of Organisations, Application Templates, Components, and Product Templates,</li> <li>— auditing of Organisations, Application Templates/Applications, Components, and Product Templates/Products,</li> <li>— monitoring the system, and</li> <li>— operation of the security of the IFMS, e.g. key management.</li> </ul>
Registrar	After the certification, the Registrar issues unique registration codes for Organisations, Components, Application Templates, and Product Templates. The Registrar function also issues unique identifiers or rules for generating unique identifiers for the Applications, Products, and messages.

5.2 Basic framework of the generic IFM functional model

The links between the operational IFM-roles of the IFMS are illustrated in Figure 1. These links represent information flows. Optional links and IFM-roles are drawn in dotted lines. It is assumed that the customer already has a medium or is provided with one by the application retailer, therefore, the model considers only application and product issues. Within an IFMS, there may be several organisations performing the functions of the IFM-roles.

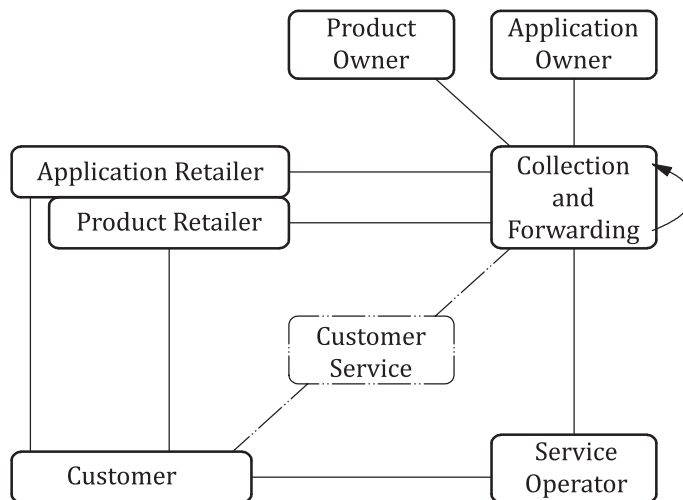


Figure 1 — Links between operational IFM-roles within the IFMS

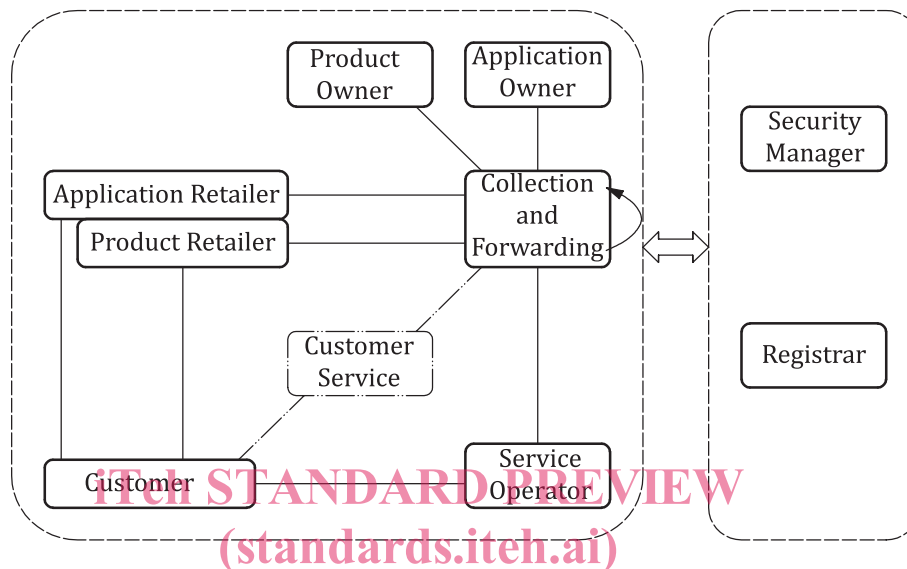
An IFM manager establishes and manages the IFM policies on behalf of the IFM. These policies are embedded in the set of rules. The IFM manager will have relationships with media issuers. The customer will have a relationship with the issuer of the customer medium they hold. Also, the application owner will have relationships with media issuers.

To manage the elements, the IFM functional model includes two management IFM-roles:

- the registrar — the IFM-role for the identification of any organization, component, application template and application, product template, and product involved in the IFMS;
- the security manager — the supporting IFM-role responsible for the secure operation of the IFMS.

Figure 2 shows the two domains of IFM-roles of the IFM and the connection between them.

The interactions between IFM-roles are described in detail in Clause 6.



**Figure 2 — Two IFM domains (operational and management IFM-roles)**

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## 6 Use Case description for the IFM functional model

This clause describes Use Cases for the operation of an IFMS. The set of Use Cases described herein provides a toolbox for the implementation of an IFMS. Where processes described within a Use Case are implemented within an IFM, the Use Case is mandatory.

However, Use Cases may be adapted with modification depending on ways of management of Applications and Products. An/A Application/Product can be managed either in a media centric or back-office centric way. Any variation or combination between these two approaches may be possible.

Media centric management:

Main processes (e.g. fare calculation, billing) of management of Application and Product are done between a Medium and MAD.

Back-office centric management:

Main processes of management of Application and/or Product are done in the back-office.

The following Use Cases describe functional aspects of the IFM. Contractual matters are outside the scope of this part of ISO 24014, but a prerequisite to implementation.

All Actors in the Use Cases are written in UPPER CASE characters.

### 6.1 Certification

Each object to be brought into the IFM should meet the IFM requirements. The proof of compliance is given by checking the object against a Set of Rules. This process is called certification.