INTERNATIONAL STANDARD

ISO
24014-1

First edition
2007-07-01

Public transport — Interoperable fare management system —

Part 1:
Architecture

Transport public — Système de gestion tarifaire interopérable —
Partie 1: Architecture

iTeh STANDARD PREVIEW

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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.

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

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

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

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

⎯ *Part 1: Architecture*

Introduction

Interoperable fare management (IFM) encompasses all systems and processes designed to manage the distribution and use of fare products in an interoperable public transport environment.

Such systems are called interoperable when they enable 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 requires also 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 IFMs. An IFM can span country boundaries, and can be combined with other IFMs. 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 is intended to assist the managers of new and existing fare management systems to find a way conveniently to establish Interoperability for the benefit of their customers.

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

a) It provides a framework for an interoperable fare management implementation with a minimum of 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 IFMs 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, *Road Transport and Traffic Telematics — Electronic Fee Collection (EFC) — Systems architecture for vehicle related transport services*;

— existing international data security standards.

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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;

— certification, registration and identification.

This part of ISO 24014 defines the following main elements:

— identification of the different functional entities 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 functional entities;

— security requirements.

This part of ISO 24014 excludes consideration of

— 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 standardisation 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, downloaded to Medium Access Devices (MADs), actioned by the MAD if and when a specific IFM Application or Product referenced in the list is encountered by that MAD

2.2
Actor
user playing a coherent set of roles when interacting with the system within a particular Use Case

NOTE   A user can, for instance, be a human, an Organisation or another (sub)system.

2.3
Application Rules
Application Owner requirements

2.4
Application Specification
specification of functions, data elements and security scheme according to the Application Rules

2.5
Application Template
technical master of the Application Specification for implementation

2.6
Application
implemented and initialised Application Template on a Customer Medium

NOTE 1   The Application is identified by a unique identifier.

NOTE 2   The Application houses Products and other optional Customer information (Customer details, Customer preferences).

2.7
Commercial Rules
rules defining the settlement and commission within the IFMS

2.8
Contract
agreement between two or more Entities

2.9
Component
any piece of hardware and/or software that performs one or more functions in the IFM

2.10
Component Provider
anyone who wants to bring a Component to the IFMS

2.11
Entity
abstract object performing a set of functions within the IFM

NOTE   An entity can exist in the real world (e.g. a service operator), in which case it is called a "legal entity". It can also be a model of this real world object ("abstract entity"). This part of ISO 24014 deals with the second kind of entity (collection of technical functions). It covers the following sets of functions: Application Owner, Application Retailer, Product Owner, Product Retailer, Service Operator, Collection and Forwarding, Security Manager, Registrar and Customer.

2.12
IFM Policies
commercial, technical and security objectives of IFM

2.13
Interoperability
ability of systems to provide services to, and accept services from, other systems

2.14
Medium
physical carrier of Applications

2.15
Message
set of data elements transferred between two Entities

2.16
Customer Medium
Medium initialised with an Application through an Application Contract

2.17
Medium Access Device
MAD
device with the necessary facilities (hardware and software) to communicate with a Customer Medium

2.18
Organisation
legal entity covering the functions and implied responsibilities of one or more of the following operational entities: Application Owner, Application Retailer, Product Owner, Product Retailer, Service Operator, and Collection and Forwarding

2.19
Pricing Rules
rules defining the price and payment relationships to the customer

2.20
Product Rules
set of Usage, Pricing and Commercial Rules defined by the Product Owner

2.21
Product Specification
complete specification of functions, data elements and security scheme according to the Product Rules

2.22
Product Template
technical master of the Product Specification for creating Products

NOTE   The Product Template is identified by a unique identifier.

2.23
Product
instance of a Product Template on a Medium stored in an Application

NOTE   It is identified by a unique identifier and enables the customer to benefit from a service provided by a Service Operator.

2.24
Seamless Travel
opportunity for customers to move between one part of an IFMS to any other part of the same or another IFMS with the minimum of inconvenience, according to their own journey plan using any combination of transport mode and Service Operator using a single Medium

2.25
Security Policy
security objectives within the IFM Policies

2.26
Set of Rules
regulations for achieving IFM Policies expressed as technical, commercial, security and legal requirements and standards relevant only to the IFMS

2.27
Trigger
event that causes the execution of a Use Case

2.28
Usage Rules
rules defining the usage time, the usage area, the personal status and the type of service

2.29
Use Case
description of typical interactions between the Actors and the (sub)system itself, capturing the functional requirements of the (sub)system by defining a sequence of actions performed by one or more Actors and the system

3   Abbreviated terms

IFM   interoperable fare management

IFMS   interoperable fare management system

IFMSA   interoperable fare management system architecture

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 recognise 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 assure 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 may 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 Organisation 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,

— a Registrar.

The functions and the responsibilities of the Security Manager and the Registrar may 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 Entities

Entities are identified by capitalized initial letters.

Product Owner   The Product Owner is responsible for his Products.

Functions of ownership:

— Specifying pricing, Usage Rules and Commercial Rules.

Functions of clearing:

— Trip reconstruction — Product aggregation based on received usage data using Product definition rules;

— Linking of aggregated usage data with acquisition data;

— Preparation of apportionment data based on Product Specification.

Functions of reporting:

— Detailed:

— acquisition data with no link to usage data within the reporting period;

— usage data with no link to acquisition data within the reporting period;

— linked aggregated Product data within the reporting period.

— Summary:

— apportionment data and clearing report.

— Total acquisition data.

Product Retailer   The Product Retailer sells and terminates Products, collects and refunds value to a customer as authorised by a Product Owner.

The Product Retailer is the only financial interface between the customer and the IFMS related to Products.

Application Retailer   The Application Retailer sells and terminates Applications, collects and refunds value to a customer as authorised by an Application Owner.

The Application Retailer is the only financial interface between the customer and the IFMS related to Applications.

Collection and Forwarding

The 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.

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 Entities 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 Entity and forward it to other IFM Entities.

— Logically there may be several COLLECTION AND FORWARDING functions within the IFM.

— IFM Entities may be linked to different COLLECTION AND FORWARDING functions, but each Entity 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 Entities 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 Entities 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

— certification of Organisations, Application Templates, Components and Product Templates;

— auditing of Organisations, Application Templates/Applications, Components and Product Templates/Products;

— monitoring the system;

— operation of the security of the IFMS, e.g. key management.

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 model

The links between the operational Entities of the IFMS are illustrated in Figure 1 — Links between operational Entities within the IFMS. These links represent information flows. Optional links and Entities 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 Entities.
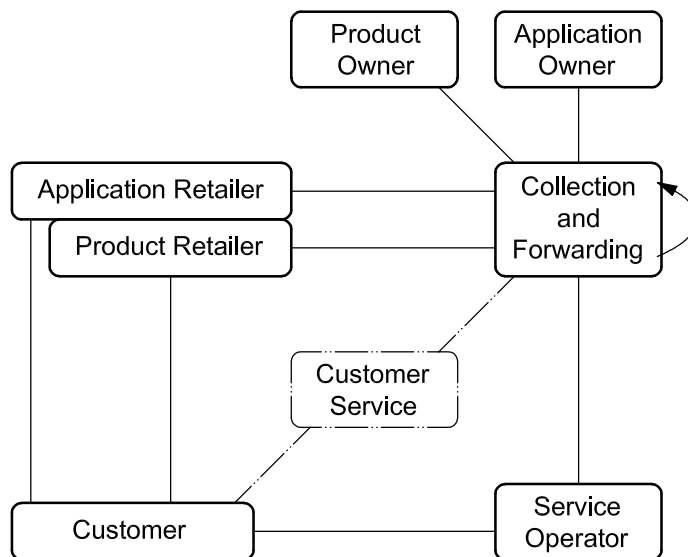

Figure 1 — Links between operational Entities within the IFMS

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 model includes two management Entities:

— the Registrar — the Entity for the identification of any Organisation, Component, Application Template and Application, Product Template and Product involved in the IFMS;

— the Security Manager — the supporting Entity responsible for the secure operation of the IFMS.

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

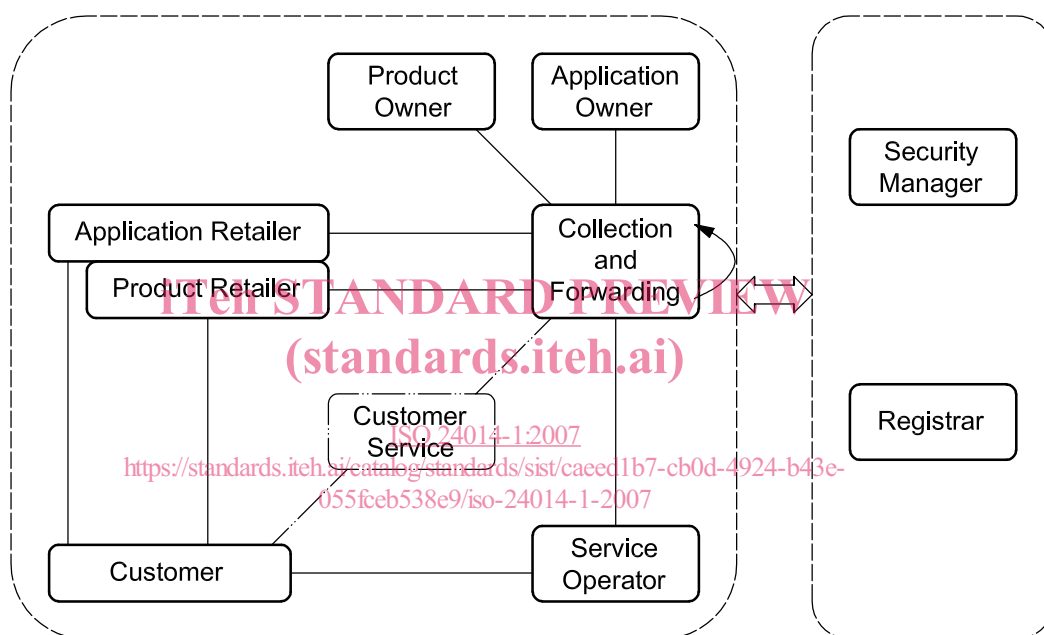The interactions between Entities are described in detail in Clause 6.

Figure 2 — The two IFM domains (operational and management Entities)

6 The Use Case description for the IFM conceptual 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.

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.