
**Intelligent transport systems —
Mobility integration — Enterprise
view**

*Systèmes de transport intelligents - Intégration des services de la
mobilité - Vue globale des rôles des organisations et des relations avec
les utilisateurs*

STANDARDSISO.COM : Click to view the full PDF of ISO/TR 7878:2023



STANDARDSISO.COM : Click to view the full PDF of ISO/TR 7878:2023



COPYRIGHT PROTECTED DOCUMENT

© ISO 2023

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
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

	Page
Foreword.....	iv
Introduction.....	v
1 Scope.....	1
2 Normative references.....	1
3 Terms and definitions.....	1
4 Abbreviated terms.....	2
5 Mobility service and transport service.....	2
5.1 Mobility service.....	2
5.2 Transport service.....	3
6 The core enterprise objects in the provision and use of mobility services.....	4
6.1 Overview.....	4
6.2 Mobility service user responsibilities.....	5
6.3 Mobility service provider responsibilities.....	7
6.4 Transport service provider responsibilities.....	8
7 Regulating, governing and supporting enterprise objects.....	9
7.1 Regulator.....	9
7.1.1 Overview.....	9
7.1.2 Regulator responsibilities.....	11
7.2 ICT service providers.....	12
7.2.1 Overview.....	12
7.2.2 ICT service provider responsibilities.....	13
7.3 Transport infrastructure operator.....	15
7.3.1 Overview.....	15
7.3.2 Transport infrastructure operator responsibilities.....	16
7.4 Payment service provider.....	16
7.4.1 Overview.....	16
7.4.2 Payment service provider responsibilities.....	17
Bibliography.....	19

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*.

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

Urbanization, changes in climate and demographic and societal changes are some of the major trends that have had an impact on transport systems and services over the last decades. Combined with the implementation of ITS services and Internet of Things (IoT), new transport concepts have been developed. User requirements on efficiency, availability and interoperability have also been driving forces for new transport concepts for the integration of multimodal, existing and new transport services as described and implemented in mobility concepts like Mobility as a service (MaaS) and Mobility on Demand (MOD). Cooperative, connected and automated mobility (CCAM) will also have a significant effect on how travellers plan and implement their journeys between multiple modes of transport in the integrated mobility environment.

Integrated mobility concepts are evolving around the world, mostly based on the MaaS and MOD concepts. Hence, there is a need for a generic, common and world-wide concept description mapping all existing and foreseen concepts for interoperable, integrated and seamless multimodal transport services.

The role and responsibility models for MaaS and MOD have already been described in ISO/TR 4447, but there is also a need for a common role and responsibility model for integrated and multimodal mobility services, recognizing and including the work already done by the two mainstream organizations for integrated mobility services, MaaS and MOD. A common role and responsibility model can be described from an enterprise view^[3] where the stakeholders, actors and roles in the MaaS/MOD ecosystem are merged into one enterprise view. The enterprise view addresses the relationships between the entities (e.g. organizations) involved in the provision of the mobility services. However, there is also a need for enhancing the MaaS and MOD models to include more services, e.g. security services, certification services and interoperability management. The following documents have been used for the enhancement of the common MaaS/MOD model (ecosystem):

- ISO 24014-1 on interoperable fare management;
- ISO 17573-1 on electronic fee collection;
- ISO/TR 21724-1 on common transport service account systems;
- EN 12896-5 on public transport fare management.

The objective of this document is to describe integrated mobility from an enterprise view to which existing implementations of integrated mobility systems can potentially be mapped. This is intended to enable a common understanding, an exchange of information and knowledge, and a convergence towards one world-wide integrated mobility concept description.

[STANDARDSISO.COM](https://standardsiso.com) : Click to view the full PDF of ISO/TR 7878:2023

Intelligent transport systems — Mobility integration — Enterprise view

1 Scope

This document describes the enterprise view (see ISO/TS 14812:2022, 3.1.4.3) of integrated mobility based on the role and responsibility models in the mobility as a service (MaaS) and mobility on demand (MOD) ecosystems as described in ISO/TR 4447. Other ISO documents (e.g. ISO 24014-1, ISO 17573-1 and ISO/TR 21724-1) have been reviewed in order to enhance and merge the MaaS and MOD role models.

The enterprise view addresses the relationships between organizations and users, and the roles those entities play in the delivery and consumption of mobility services. Relationships between entities are dependent on the roles those entities take in the delivery of user services.^[3]

Enterprise objects interact to exchange information, manage and operate systems beyond the scope of one organization. The enterprise view focuses on the relationships between those enterprise objects, but also defines how enterprise objects interact with physical objects, which appear in the enterprise view as "resources".

This document focuses on mobility service concepts where the included transport services are publicly available. Examples of such transport services are listed in [Clause 3](#).

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/TS 14812, *Intelligent transport systems — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/TS 14812 and the following apply.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

mobility service

service that provides an integrated interface for multiple transport services

Note 1 to entry: The integrated interface can include an online interface, a payment interface, and/or rules for physically accessing the various transport services.

Note 2 to entry: The typical goal of a mobility service is to fulfil the needs of a transport user in an optimal fashion, even if that requires using multiple transport services.

3.2

mobility service provider

entity that delivers one or more mobility services

4 Abbreviated terms

AI	artificial intelligence
ARC-IT	Architecture Reference for Cooperative and Intelligent Transportation
GNSS	Global Navigation Satellite System
ICT	information and communication technologies
IFM	interoperable fare management
IFMS	interoperable fare management systems
ITS	intelligent transport systems
MaaS	mobility as a service
MOD	mobility on demand
PT	public transport
PTA	public transport authority
PTO	public transport operator
UITP	Union Internationale des Transport Publics
USDOT	United States Department of Transportation
VRU	vulnerable road user

5 Mobility service and transport service

5.1 Mobility service

Integrated mobility is based on two crucial services: the mobility service and the transport service.

The European MaaS concept describes a mobility service as the integration of various forms of transport services into a single mobility service accessible on demand.^[4] According to Reference [4], the core purposes of the service are:

- to facilitate a diverse menu of transport alternatives, for example public transport, ride-sharing, car-sharing, bike-sharing, taxi or car rental/lease, or a combination thereof;
- to offer added value to the user through the use of a single application to provide access to mobility, with a single payment channel instead of multiple ticketing and payment operations;
- to be the best-value proposition for users by helping them to meet their mobility needs and solve the inconvenient parts of individual journeys as well as the entire system of mobility services.

The main goal of the mobility service is to provide an alternative to the use of the private car that can be as convenient, more sustainable, help in reducing congestion and constraints in transport capacity, and reduce costs.^[4]

The United States Department of Transportation (USDOT) uses the term mobility on demand (MOD) to represent its vision for future mobility, which is a safe, reliable and carefree mobility ecosystem that supports complete trips for all, both personalized mobility and goods delivery.^[11]

According to Reference [11], the core purpose of the service is:

- to leverage innovative technologies and facilitate public private partnerships to allow for a user-centric approach that improves mobility alternatives for all travellers and the delivery of goods and services.

USDOT's MOD vision does recognize private car for private use as a possible mobility service option for some, just like walking and cycling.

The International Association of Public Transport (Union Internationale des Transport Publics - UITP) defines the mobility service as the integration of, and access to, different transport services (such as public transport, ride-sharing, car-sharing, bike-sharing, scooter-sharing, taxi, car rental, ride-hailing, etc.) in one single digital mobility offer, with active mobility and an efficient public transport system as its basis.^[1]

According to Reference [1], the core purposes of the service are:

- to provide a tailor-made service suggesting the most suitable solutions based on the user's travel needs;
- to be available anytime and to offer integrated planning, booking and payment, as well as en-route information in order to provide easy mobility and enable a way of living that does not require car ownership.

These three definitions for the term "mobility" service can be synthesized as:

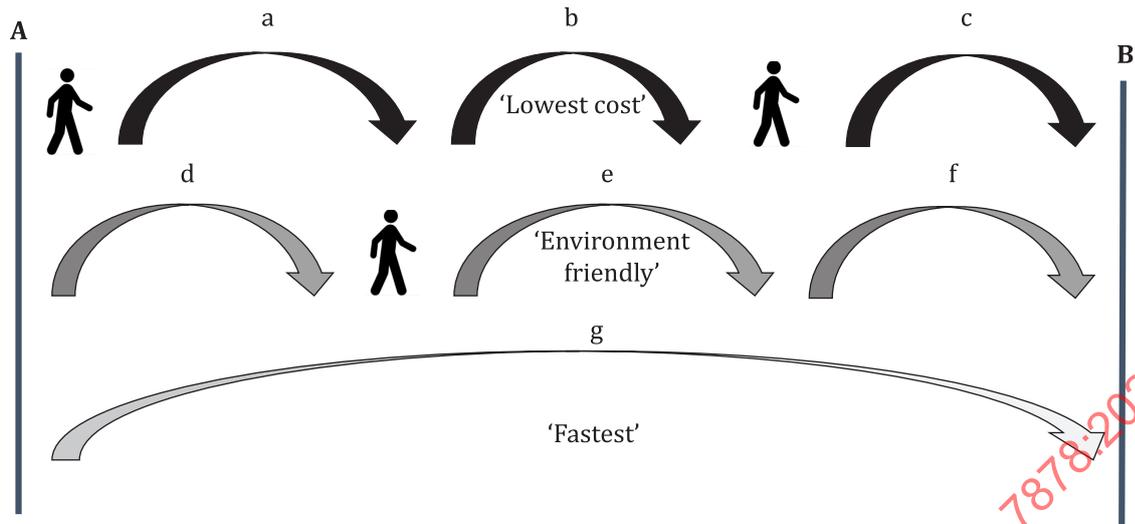
A mobility service is the integration of, and access to, different transport services that are integrated into a single mobility service representing the best value proposition for the user and being accessible anytime on demand.

In this document, the term "mobility service" is defined as a service that provides an integrated interface for multiple transport services; see 3.1.

5.2 Transport service

The term transport service is defined in ISO/TS 14812 as a service that delivers one or more material entities from one location to another to satisfy a need. A note to the definition says that the entities delivered can be people and/or goods.

Figure 1 shows the relationship between a mobility service and multiple transport services. In the example shown in the figure, the user used a mobility service provider to generate alternatives for transport from A to B. In this example, the user receives three different proposals representing the "lowest cost", most "environment-friendly" and "fastest" way to get from A to B. Two of the proposals include walking between transport services while the third one is a single door-to-door transport service, e.g. by taxi.



Key

- a subway line 1 (jurisdiction A)
- b subway line 2 (jurisdiction A)
- c bus line 3 (jurisdiction B)
- d bus line 4 (jurisdiction A)
- e bus line 5 (jurisdiction B)
- f e-scooter sharing (privately operated)
- g car (e.g. taxi)

NOTE Each link (i.e. key references "a" through "g") represents a transport service.

Figure 1 — The relationship between mobility services and transport services

Transport services are categorized in different ways by different concepts, e.g. the MaaS, MoD and UITP concepts. A synthesis of different categories can be summarized in the four main attributes that describe a transport service.

- 1) Accessibility: whether the transport service is accessible by the public or only for private access.
- 2) Financing: whether the transport service is fully or partly financed by the authorities, or if it is commercial, it is a public-private financial model, it is mutual benefit, fractional or completely paid by the user.
- 3) Item transported: whether it is a person or goods.
- 4) Operational: whether the service is sequential or concurrent, where concurrent can be further divided into fixed-route, dynamic route and paired on-demand.

6 The core enterprise objects in the provision and use of mobility services

6.1 Overview

Figure 2 shows an enterprise view of the three core objects, "mobility service user", "mobility service provider" and "transport service provider", based on the responsibilities described in 6.2 to 6.4.

The enterprise view presented in Figure 2 is based on a service provider model where the mobility service provider buys the transport services from the different transport operators and resells them under their own conditions, i.e. by repackaging and repricing the services. In this model, the mobility service provider would take over the user relations including responsibilities. From a legal point of

view, issues could arise around the pricing, e.g. for public transport services where fares and discounts are often fixed by laws or regulations that have to be respected.^[2]

NOTE See Reference [2] for a description of other models, e.g. agency model, merchant model and transactional model.

Sharing of data and responsibilities as well as commercial rules are crucial issues in integrated mobility service ecosystems.

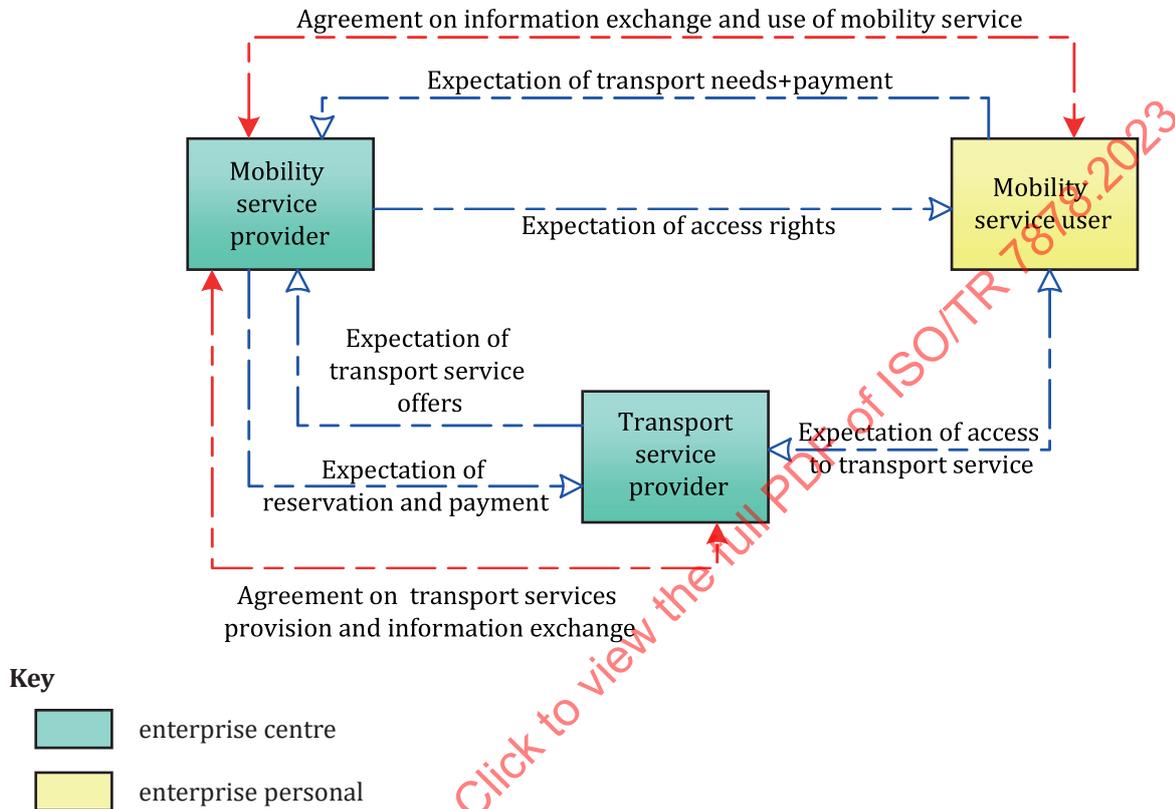


Figure 2 — Enterprise view for the three core enterprise objects

6.2 Mobility service user responsibilities

The enterprise object using the mobility service is called the mobility service user. The user is very often the entity that requests the mobility service, selects the mobility service fulfilling the user needs and preferences, uses the service and pays for it. However, the user responsibilities/activities can be divided between different persons, organizations, legal entities etc. This is also the case in interoperable fare management systems (see ISO 24024-1) where the public transport user is divided into the enterprise objects, "passenger" and "customer". The passenger is the person travelling with the public transport means and the customer is an entity that has an explicit or implicit agreement with the product owner via a retailer and pays for the service. e.g. a parent books and pays a public transport service for a child and an employer book and pays for an employee. This could also be the case for mobility services.

The MOD also includes the transport of goods, in which case the user is not travelling, but the user is still the entity that requests the mobility service, selects the mobility service fulfilling the user needs and preferences, uses the service and pays for it.

Mobility services also include transport services where the user is not a passenger, but rather the driver of the transport means used for the transport service. Finally, the user of a mobility service will sometimes be a non-motorized user as part of a mobility service, e.g. when walking from one transport service to another transport service being part of the mobility service.

The term vulnerable road user (VRU) is described in ISO/TR 24317:—¹⁾. The term is differently defined in regulations and standards published by SAE, European Union and ETSI. In relation to mobility services, a VRU could be both a driver and a non-motorized user.

Table 1 shows how other transport service concepts have named the user of the service, thereby enabling a comparison of the roles in this document with similar roles in MaaS, MOD and UITP documents and in other ISO documents involving a user of a transport-related service.

Table 1 — Terms related to "mobility service user" in other transport-related documents

Term used in this document	MaaS	MOD	UITP	ISO 24014-1	ISO 17573-1	ISO/TR 21724-1	EN 12896-5
Mobility service user	Customer	Consumer NOTE Customer is sometimes called "Mobility Manager" in the US. (MOD)	Traveller Customer	Customer Passenger	User of the service	Transport service user	Transport user role

Based on the descriptions of the enterprise object responsibilities in the 7 reference sources listed in Table 1 and a further detailing of those, the responsibilities of the enterprise object mobility service user can be as follows.

- Agree to an explicit or implicit agreement with the mobility service provider on the exchange of information needed for the delivery and use of mobility services.
- Identify the user's transport needs and send a request to a mobility service provider. The request will also usually contain information about the user, for example, user category (e.g. children, adults, seniors and people with reduced mobility and the number of travellers in each category). The request can also contain the desired time of departure or arrival and preferences regarding means of transport, number of stops and maximum waiting time when changing from one transport service to another. The request can also contain preferences such as most environmentally-friendly, shortest travel time and lowest price.
- Receive different alternatives from the mobility service provider and evaluate the different alternatives, select the preferred option, and book this.
- Receive and store the access rights to the mobility service and present these when using the mobility service. The access rights can be stored, for example, in an app in a mobile phone, a wireless smart card, an electronic tag with a unique code, a smartwatch or any electronic medium that can communicate with the provider of the transport service's local or central system, e.g. validators installed in buses or QR codes readers on a shared el-scooter. Ideally, the user ought to be able to use the same medium to access all the different transport services in a mobility service, but in practice this is difficult before there is a common system that has technical, functional and contractual interoperability between all actors involved in the mobility service provider ecosystem.
- Use the mobility service according to the terms that apply to the service, e.g. usage and pricing rules.
- Pay for the mobility service. The easiest way for the user could be to link the use of mobility services to a bank account, a credit card account or a common transport service account (see ISO/TR 21724-1), but there are also other solutions such as electronic values stored in the same medium (e.g. a mobile phone or smart card) that stores and presents the access rights. As the user uses the mobility

1) Under preparation. Stage at the time of publication: ISO/DTR 24317:2023.

service, the various providers of transport services will retrieve electronic values from the medium corresponding to the price of the service (pay-as-you-go).

6.3 Mobility service provider responsibilities

Table 2 shows how other transport service concepts have named the provider of the service, thereby enabling a comparison of the roles in this document with similar roles in MaaS, MOD and UITP documents and in other ISO documents involving a provider of a transport-related service.

Table 2 — Terms related to "mobility service provider" in other transport-related documents

Term used in this document	MaaS	MOD	UITP	ISO 24014-1	ISO 17573-1	ISO/TR 21724-1	EN 12896-5
Mobility service provider	MaaS provider	MOD operator	MaaS Provider Integrator	Product owner and Product retailers ^a	Toll service provider	Transport service manager Mobility service manager	Fare product owner role and its Fare product retailers
^a A mobility service provider has many similarities with the "product owner" role in ISO 24014-1 as the mobility service providers describe the recommended use of the mobility service (usage rules), the recommended payment means for the service (pricing rules) and the recommended means for sharing the income for a service between the involved stakeholders (commercial rules). The mobility service providers can also have retailers in the same way as the product owner in an interoperable fare management systems (IFMS).							

Based on the descriptions of the enterprise object responsibilities in the 7 reference sources listed in Table 2 and a further detailing of those, the responsibilities of the enterprise object mobility service provider can be as follows.

- Establish an explicit or implicit agreement with the Mobility service user on the exchange of information needed for the delivery and use of mobility services.
- Acquire/procure and integrate real time multi-modal system performance data.
- Establish an agreement with the transport service providers on transport service provision.
- Prepare a policy for the delivery of mobility services in accordance with the laws and regulations relevant to this type of services. Such a policy would also ensure transparency for all actors involved, fair treatment of all providers of transport services, liabilities and safeguarding the privacy of users of the mobility services. The policy would need to take into consideration the regulator(s) policy/policies.
- Prepare a joint agreement that secures the rights and obligations of the enterprise objects involved and that describes the commercial rules for the distribution of income, expenses and any discounts and the rules for the delivery, access to and use of data. Such an agreement can also describe standards and specifications that ensure technical and functional interoperability, and it can describe quality requirements for the transport services offered.
- Collect and process offers for transport services from transport service providers.
- Develop and offer safe, efficient, affordable, flexible and environmentally-friendly mobility services, combining the offers from the individual providers of transport services in a fair and impartial manner and taking into consideration the regulator policies and requirements valid for both public and private mobility service providers. It is recommended for the mobility service provider to consider the dynamic status of the infrastructure and the status of the transport services, e.g. poor service level in a road network and temporarily reduced capacity of a provider of transport services. The mobility services provider is expected to enable an easy choice for the users based on their own preferences, e.g. fastest trip, most environmentally-friendly trip or cheapest trip.

- Accept bookings from users and confirm the user access to the transport service by confirmed reservations to transport service providers.
- Give access rights on a suitable medium (or two or more media) to users who have ordered a mobility service, so that the user can experience a seamless mobility service.
- Inform the user before or during use of the mobility service and/or transport services about changes that have an impact on the mobility service, e.g. significant delays, cancellations or rerouting.
- Enable the user to pay for a mobility service in a simple, secure and efficient way so that the user experiences dealing with a single payment interface.
- Pay the transport operators for transport services provided in line with the commercial rules for the mobility service.
- Ensure that the user's privacy is safeguarded throughout the value network.
- Monitor the quality of the mobility service and possibly enforce quality deviations according to the agreement.
- Process data on the purchase and use of mobility services and distribute anonymized data to authorized recipients, e.g. transport service providers and transport authorities.

Some of the responsibilities mentioned here are carried out by the IFM manager in ISO 24014-1.

The mobility service provider responsibilities could be performed by different actors, such as the public transport authority (PTA), any transport operator, an innovative private company or organization or companies from banking, telecommunications or other sectors.^[2] A group of local transport service providers, for example, public transport operators (PTOs), could also join forces and establish an umbrella organization that could act as a mobility service provider.

6.4 Transport service provider responsibilities

Table 3 shows how other transport service concepts have named the provider of the service, thereby enabling a comparison of the roles in this document with similar roles in MaaS, MOD and UITP documents and in other ISO documents involving a user of a transport-related service.

Table 3 — Terms related to "transport service provider" in other transport-related documents

Term used in this document	MaaS	MOD	UITP	ISO 24014-1	ISO 17573-1	ISO/TR 21724-1	EN 12896-5
Transport service provider	Transport operator	Public Transit Agency Transport Service Provider Logistics Service provider	Transport operator	Service operator	Toll charger	Transport Operations Manager	Service operator role

Based on the descriptions of the enterprise object responsibilities in the 7 reference sources listed in Table 3 and a further detailing of those, the responsibilities of the enterprise object transport service provider can be as follows.

- Develop transport services offered to mobility service providers including information about vehicle/device characteristics to match with requirements from the mobility service user. Examples include: wheelchair-accessible vehicle (for wheelchair users); sedan vs. van/SUV (for some it can be difficult to get into/out of certain sized vehicles due to mobility disabilities, injuries, or age); car seat or booster seat (for young children); vehicle capacity (for non-fixed route PT providers); fuel source

(for users who want to optimize by lowest environmental impact). The information on the transport services can also include establishing and tailoring pricing levels and structure.

The transport services can be regular, for example, described through route plans and tariff structures, or there could be transport services provided on request. Examples of the first are ordinary public transport services provided by a public transport company or mobility company. Examples of the second can be the transport of people by taxi or the transport of an item from door to door.

- Offer their transport services to mobility service providers who use the transport services to combine them with transport services from other providers so that the user can be offered a set of mobility services consisting of integrated and multimodal transport services.
- Accept and confirm orders for transport services from the mobility service providers.
- Reserve capacity on their means of transport (and transport system infrastructure) or increase their capacity when the demand is more than normal capacity.
- Deliver the transport service to users who have access rights ('tickets') to the transport service, e.g. an access right stored on a mobile phone and presented to a QR-reader operated by the transport service provider.
- Monitor the execution of the transport service in relation to the planned delivery of quality, e.g. compliance with timetables and number of users in relation to capacity. Notify the mobility services provider of any discrepancies so that the provider can take into account the discrepancies with regard to other users who are affected by the discrepancies and implement necessary measures. An example of such a measure could be if users on board a bus do not catch a train departure that was part of the mobility service. Then the mobility service provider can move the orders to the train operator for the next train departure or find other transport services that can compensate for the loss of the planned transport service.
- Redirect the means of transport, if necessary, e.g. in the event of incidents in a road or street network that result in major delays.
- Send claims to the mobility services provider about delivered transport services so that the provider of the transport service can get its share of the price that the user has paid for the mobility service.

7 Regulating, governing and supporting enterprise objects

7.1 Regulator

7.1.1 Overview

[Figure 3](#) shows the enterprise view for the regulator and the three core enterprise objects (see [Clause 6](#)). The transport service provider has an agreement with the regulator, e.g. a licence to operate as a commercial provider of transport services. The mobility service provider has the same type of agreement with the regulator. There is also an agreement between the transport service provider and the mobility service provider as described in [Clause 6](#). [Figure 3](#) does not include the expectations shown in [Figure 2](#), but focuses on the expectations related to the Regulator.

Both the transport service provider and the mobility service provider expect to receive the legal and operational framework for their operation. The frameworks can include legislation, policies, recommendations, guidelines and specifications, for example. In return, the regulator expects reports on the provision of the transport services and mobility services enabling the regulator to monitor the implementation and operation of service providers. The regulator can also expect to receive the user transport needs enabling the regulator to take the user needs into account in the agreements with the transport service providers and mobility service providers, e.g. needs related to regularity, service quality, access for disabled travellers and fee structures.

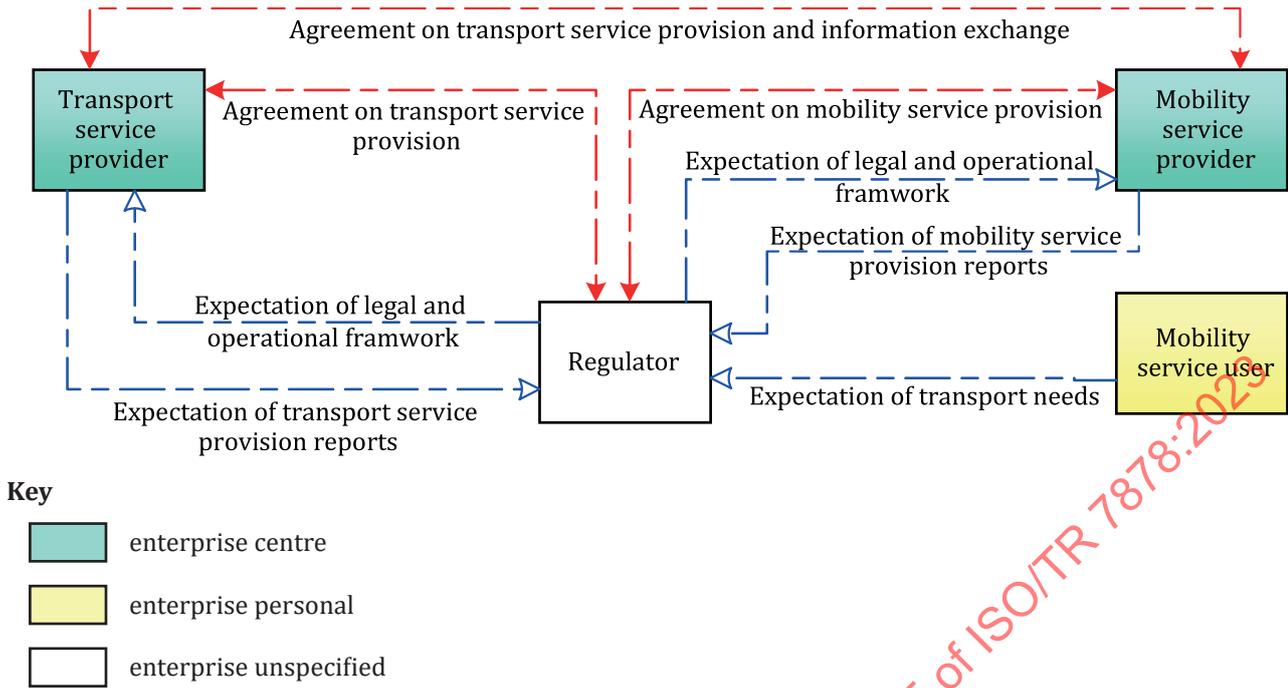


Figure 3 — Enterprise view for the regulator and the three core enterprise objects

There will probably never be one legal entity that is able to fulfil all the responsibilities listed in 7.2. There will be regulators on federal, national, regional, city and local levels in a legal, administrative, and operational hierarchy. Some examples of MaaS and MoD actors that fulfil certain parts of the responsibilities are shown in Figure 4.

Local authorities play a key role within the IFM manager functions to be carried out. Even in case of national approaches, local situations are to be controlled by local transport authorities.

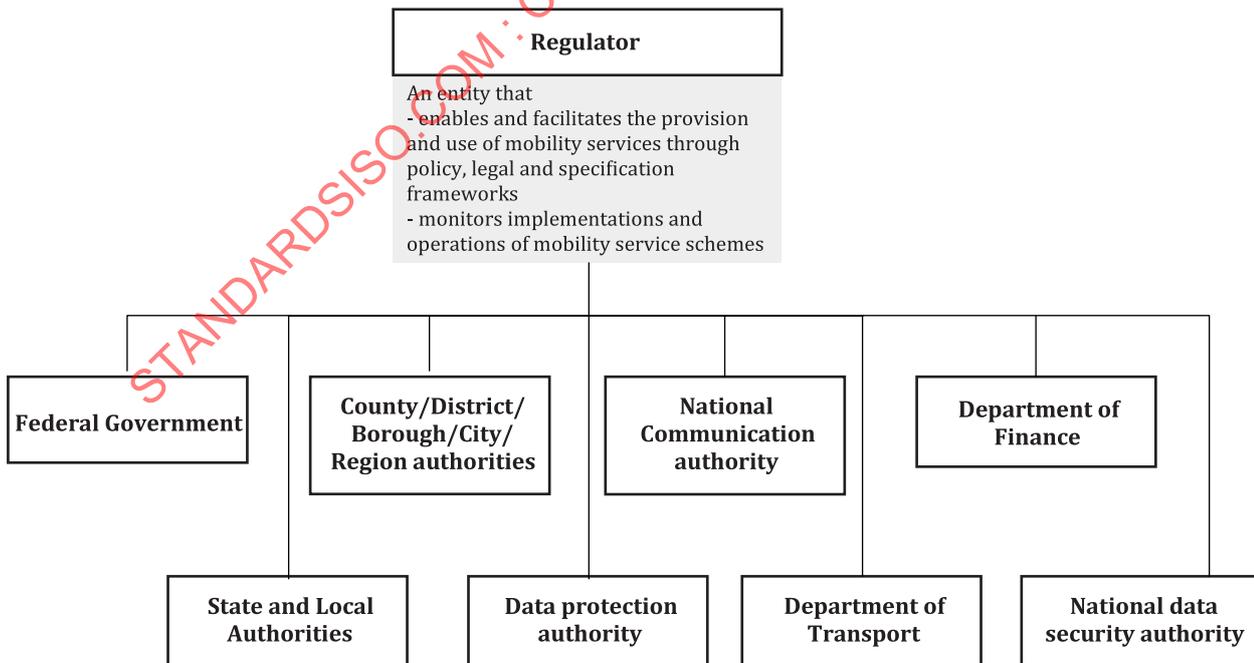


Figure 4 — Examples of actors fulfilling parts of the regulator responsibilities

7.1.2 Regulator responsibilities

There are entities both in MaaS and MOD that have the main responsibilities of enabling and facilitating the provision and use of mobility services through policy, legal and specification frameworks. In MaaS these entities are named regulators and policy makers and in MOD the entities are named federal government and state and local authorities. The responsibilities of these are comparable to the role the interoperability manager in IFMS architecture (see ISO 24014-1) and in interoperable electronic fee collection (tolling) (see ISO 17573-1). [Table 4](#) shows the roles with comparable responsibilities.

Table 4 — Terms related to "regulator"

Term used in this document	MaaS	MOD	UITP	ISO 24014-1	ISO 17573-1	ISO/TR 21724-1
Regulator	Regulator and policy maker	Federal government State and local authority	Regulator	IFM manager Registrar Security Manager	Interoperability manager	Not defined

Based on the descriptions of the role responsibilities in the reference sources listed in [Table 4](#) and a further detailing of those, the responsibilities of the regulator can be as follows.

a) Regarding policy frameworks and recommendations:

- define the goals for an integrated mobility service scheme, e.g. reduce or remove the use of private cars in urban areas or improve the quality of life in rural and low-density areas with limited access to transport services;
- define a policy for ensuring all users basic rights, safety, privacy and mobility service quality;
- establish policy and criteria for government funding eligibility for mobility services;
- define a policy for social inclusion and equity, e.g. ensuring access for users with disabilities, unbanked and underbanked users, and users without access to smartphones or the mobile internet;
- define a security policy for mobility service schemes including an over-arching management of interoperable security;
- define a policy for a sustainable development of the mobility service market ensuring fair competition between the actors in the ecosystem while taking into account the combination of public and private actors having different goals and prerequisites and the different conditions in urban, rural and low-density areas;
- define a policy for pricing and commercial rules, for example, fares and fees structures, incentives, price quoted and a fair distribution of costs and incomes, also covering transport services where surge pricing is used for the management of transport service capacity;
- define a policy for economic consequences and allocation of responsibilities related to unavailable or inaccessible services;
- define a policy for ensuring technical, functional and contractual interoperability within and between mobility service schemes, e.g. through existing or new international standards for interoperable services and data formats;
- define a policy for the certification and/or approval of actors involved, and equipment used in the mobility service schemes;
- define a policy for data ownership and sharing of data generated, collected and needed for the provision of mobility services;

- support these policies through legislation, specifications, research and pilots;
- promote and support relevant international standardization

Some of the functions mentioned here are carried out by the IFM Manager in ISO 24014-1.

b) **Regarding monitoring and governing:**

- monitor the implementation of mobility services schemes by public and private entities and their adherence to the laws, regulations, and regulator policies and specifications;
- manage disputes between actors in mobility service schemes;
- define and maintain ID-schemes and, if necessary, support the issuing of IDs, ensuring unique registration codes for organizations and components and unique identifiers or rules for generating unique identifiers for the mobility service applications and messages in line with relevant international standards;
- define and maintain security schemes;
- give or withdraw permissions to operate to involved actors;
- give or withdraw permissions to install and operate equipment used in a mobility service scheme.

7.2 ICT service providers

7.2.1 Overview

[Figure 5](#) shows the enterprise view for the ICT provider, the three core enterprise objects and the regulator. The transport service provider, the mobility service provider and the mobility service user have agreements with the ICT provider on ICT services provision and information exchange. Some examples of ICT services are shown later in [Figure 6](#).

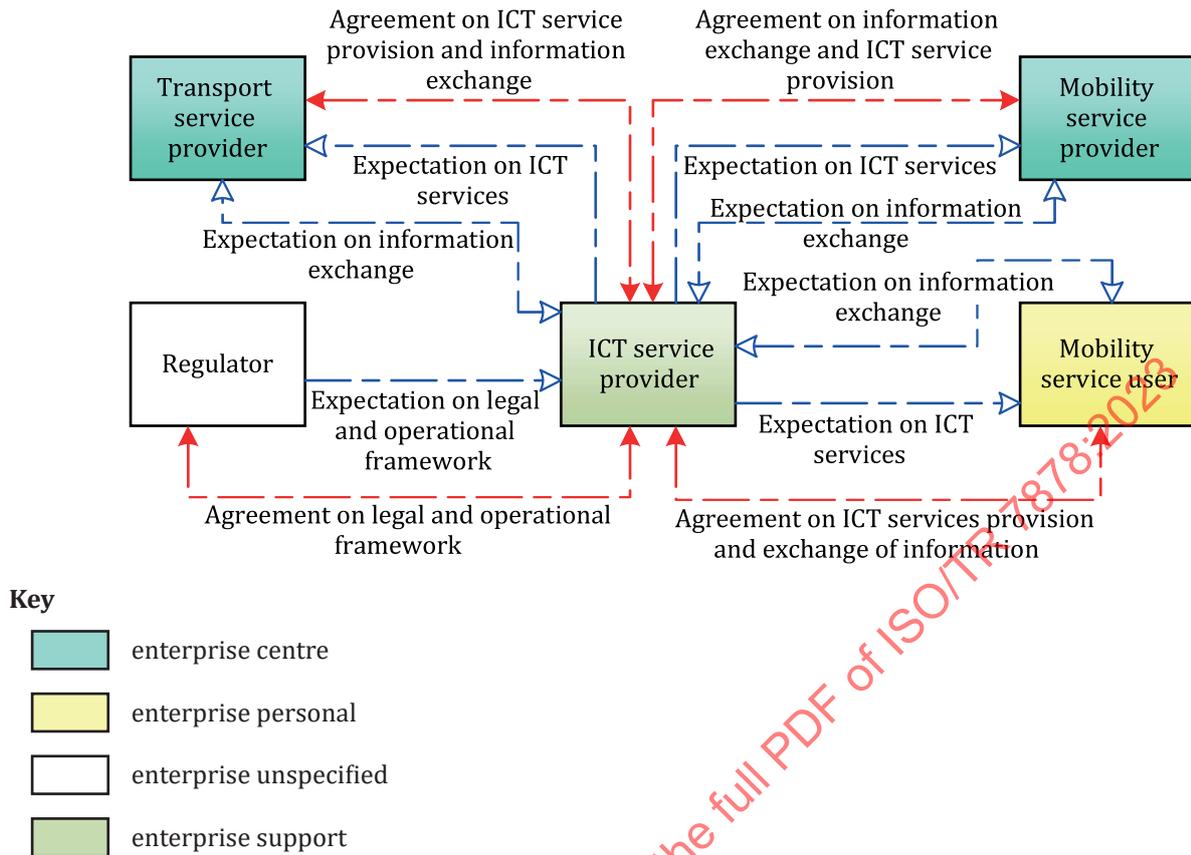


Figure 5 — Enterprise view of ICT service providers and core enterprise objects

In addition to the ICT service expectation, there are also expectations related to the exchange of information as part of the ICT services provided.

The ICT service provider is expected in most cases to adhere to the legal and operational framework provided by the regulator and in some cases the ICT service provider is also expected to have an agreement with the regulator on the legal and operational framework (e.g. regulations and specifications) issued by the regulator. An example on this can be a telecommunication network provider that is required to apply for a licence or concession to operate in compliance with the regulations and specifications issued by a telecom authority.

7.2.2 ICT service provider responsibilities

Table 5 shows how Maas and MOD concepts have named the ICT provider, thereby enabling a comparison of the roles in this document with similar roles in MaaS and MOD.

Table 5 — Terms related to ICT providers

Term used in this TR	Covering MaaS roles	Covering MOD roles	Main responsibilities (simplified)
ICT service provider	Technical backend providers ICT infrastructure ICT companies	Technology enablers	Provide and operate the ICT infrastructure and services, e.g. hardware, software/applications and communication networks needed for the provision of the mobility service.

Some examples of enterprise objects that can be placed in the ICT service provider category are collected from MaaS, MOD and other ISO documents involving a provider of a transport services or ITS services; these are shown in Figure 6.

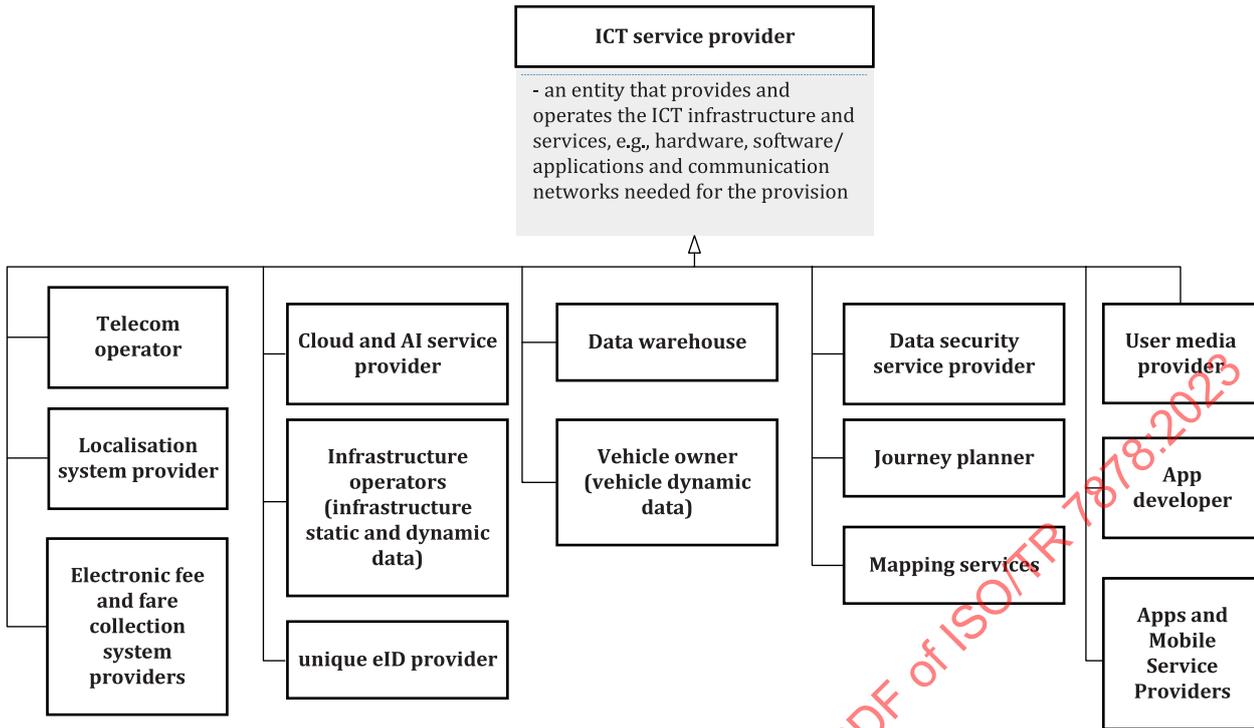


Figure 6 — Examples of actors fulfilling parts of the ICT service provider responsibilities

Based on the descriptions of the role responsibilities in the MaaS and MOD documents and other documents for ITS services (e.g. ISO 24014-1 and ISO 17573-1) as well as a further detailing of those, the responsibilities of the ICT service provider can be as follows.

- Provide telecom network services, e.g. mobile phone network services.
- Provide localization services, e.g. Global Navigation Satellite System (GNSS) services, mapping services and localization augmentation communication services.
- Provide fare management systems and fare collection services ("ticketing systems").
- Provide electronic fee collection services used for vehicle related transport services.
- Provide cloud services and AI (artificial intelligence) services.
- Provide transport infrastructure equipment used for data collection of transport infrastructure status and provision of ITS services.
- Provide unique and secure eIDs used for identification of users, equipment, applications, services, data, etc.
- Provide sensors and dynamic data from vehicles, e.g. buses, e-scooters, private cars, etc. (Internet of Things).
- Provide data security services, e.g. trusted third parties providing security schemes and key infrastructure and management.
- Provide journey-planning tools and other user-requested applications for mobility services.
- Provide mobility service user media, for example, smartphones or any other electronic device that could be used for e.g. storage of access rights or planning and booking mobility services.