
**Intelligent transport systems (ITS) —
Nomadic device service platform for
micro mobility —**

**Part 3:
Data structure and data exchange
procedures**

*Systèmes de transport intelligents (ITS) — Plate-forme de services via
appareils nomades pour la micro-mobilité —*

Partie 3: Structure des données et procédures d'échange de données

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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

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Contents

Page

Foreword	v
Introduction	vi
1 Scope	1
2 Normative references	1
3 Terms, definitions and abbreviated terms	1
3.1 Terms and definitions	1
3.2 Abbreviated terms	2
4 Overview	3
4.1 Introduction	3
4.2 Message overview	4
5 Data structure	5
5.1 Data structure for request-mm-status	5
5.2 Data structure for mm-status-response	5
5.3 Data structure for stop-notify-mm-status	6
5.4 Data structure for notify-mm-service	6
5.5 Data structure for stop-notify-mm-service	7
5.6 Data structure for charging-station-information	8
5.7 Data structure for parking-space-information	8
5.8 Data structure for reservation-information	9
5.9 Data structure for public-transit-schedule	10
5.10 Data structure for public-transit-reserved-information	10
5.11 Data structure for navigation-route-information	11
5.12 Data structure for traffic-information	11
5.13 Data structure for accident-information	12
5.14 Data structure for danger-zone-information	12
5.15 Data structure for warning-message	13
5.16 Data structure for toll-balance-information	14
5.17 Data structure for disconnection-warning-message	15
5.18 Data structure for return-information	16
5.19 Data structure for payment-information	17
5.20 request-public-transit-schedule	18
5.21 request-public-transit-reservation	18
6 Data exchange procedure	19
6.1 Overview	19
6.2 Pre-trip	19
6.2.1 General	19
6.2.2 UC 1.1 MM information providing service	19
6.2.3 UC 1.2 Navigation service-linked information on charging station	20
6.2.4 UC 1.3 Pre-scanning available parking space service	21
6.2.5 UC 1.4 MM sharing service	22
6.2.6 UC 1.5 MM as an integrated mobility service	23
6.3 En-route	24
6.3.1 General	24
6.3.2 UC 2.1 Traffic information providing service	24
6.3.3 UC 2.2 MM status monitoring service	25
6.3.4 UC 2.3 Mobile tolling service	26
6.3.5 UC 2.4 Adaptive route management service	27
6.3.6 UC 2.5 Searching available parking space service on the way	28
6.3.7 UC 2.6 Keyless go service for shared MM	29
6.3.8 UC 2.7 Interconnected transfer information providing service	30
6.4 Post-trip	31
6.4.1 General	31

6.4.2	UC 3.1 MM driving information providing service	31
6.4.3	UC 3.2 Charging station information service.....	32
6.4.4	UC 3.3 Parked MM position providing service	33
6.4.5	UC 3.4 Shared MM return service	34
Bibliography		36

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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.

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*.

A list of all parts in the ISO 22085 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

Micro mobility can be defined as a small or compact-sized electric vehicle. Normally, it is designed to be used as a first-mile and last-mile service connecting public transit routes or to provide personal mobility with one or two passengers for a short-distance trip.

The nomadic device service platform aims to accommodate the specific needs of integrated mobility services for either urban or rural areas. The service platform focuses on the use of data exchange interface standards between micro mobility and nomadic devices to enable the development of cloud-based ITS using wireless networks.

This document fosters the introduction of nomadic devices in the public transport and automotive world. It specifies the data structure and data exchange procedure based on Data eXchange Messages (DXMs) at the application level regarding pre-trip, post-trip and while driving, in order to identify connectivity among a user's personal ITS station (P-ITS-S, for example nomadic devices), vehicle-ITS-station gateway (V-ITS-S) and central ITS station (C-ITS-S).

This document covers subjects related to mobility services using micro mobility, including micro mobility sharing, parcel delivery and first-mile and last-mile connections in urban areas. This DXM implementation describes how such mobility services based on micro mobility are provided using a P-ITS-S.

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Intelligent transport systems (ITS) — Nomadic device service platform for micro mobility —

Part 3: Data structure and data exchange procedures

1 Scope

This document specifies the data structure and data exchange procedure related to micro mobility service applications utilizing a P-ITS-S (i.e. nomadic devices), including car sharing, parcel delivery and first-mile and last-mile connections. In addition, this document delivers related requirements for the development and operation of the service platform between nomadic devices and micro mobility with intelligent transport systems (ITS) technologies.

This document defines a data structure and data exchange procedure based on the datasets and messages which are defined in ISO 22085-2.

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 21217, *Intelligent transport systems — Station and communication architecture*

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3 Terms, definitions and abbreviated terms

For the purposes of this document, the terms and definitions given in ISO 21217 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 Terms and definitions

3.1.1

central ITS station

C-ITS-S

ITS station assuming a central role

3.1.2

personal ITS station

P-ITS-S

implementation of an ITS station as a personal ITS subsystem (e.g. nomadic device or mobile device) which provides communication connectivity via a wireless communication network (3G, 4G, and 5G), mobile wireless broadband (WiMAX, HC-SDMA, etc.), WiFi and short-range links, such as Bluetooth, Zigbee, etc. to connect portable devices to the motor vehicle communications system network

3.1.3

micro mobility

MM

eco-friendly personal electric vehicle for one or two passengers

3.1.4

in mobility network

IMN

local network bus among electrical control units in *micro mobility* (3.1.3), providing diagnostics information to a *P-ITS-S* (3.1.2) through a *V-ITS-SG* (3.1.8)

3.1.5

micro mobility service provider

MMSP

service provider for *micro mobility* (3.1.3), including parking lot management service, public transit authority, charging station management service, tolling service authority, car sharing service and traffic information service, amongst others

3.1.6

micro mobility communication network

MMCN

communication network between *P-ITS-S* (3.1.2) and *C-ITS-S* (3.1.1)

3.1.7

public communication network

PCN

network between micro mobility cloud servers (MMCS) and *micro mobility service providers* (3.1.5) used to provide *micro mobility* (3.1.3) services information on, for example, charging stations, parking lots and traffic congestion

3.1.8

vehicle-ITS-station gateway

V-ITS-SG

ITS-S node used to interconnect two different OSI protocol stacks at layers 5 through to 7 between an *in mobility network* (3.1.4) and a *P-ITS-S* (3.1.2)

3.2 Abbreviated terms

C	conditional
DTC	diagnostic trouble code
DXM	data exchange message
EXE	executor
IMN	in mobility network
ITIPS	interconnected transfer information providing service
ITS	intelligent transport systems
ND	nomadic device
M	mandatory
MM	micro mobility
MMCS	micro mobility cloud server

MMIMS	Micro mobility as an integrated mobility service
MMSRS	micro mobility sharing service
0	optional
SAPSS	searching available parking space service
SOC	state of charge

4 Overview

4.1 Introduction

Conceptual aspects of the general use cases in ISO/TR 22085-1 are depicted in [Figure 1](#) and are summarized in [Table 1](#). Details of ITS-S (i.e. V-ITS-S, P-ITS-S, and C-ITS-S) are specified in ISO 21217.

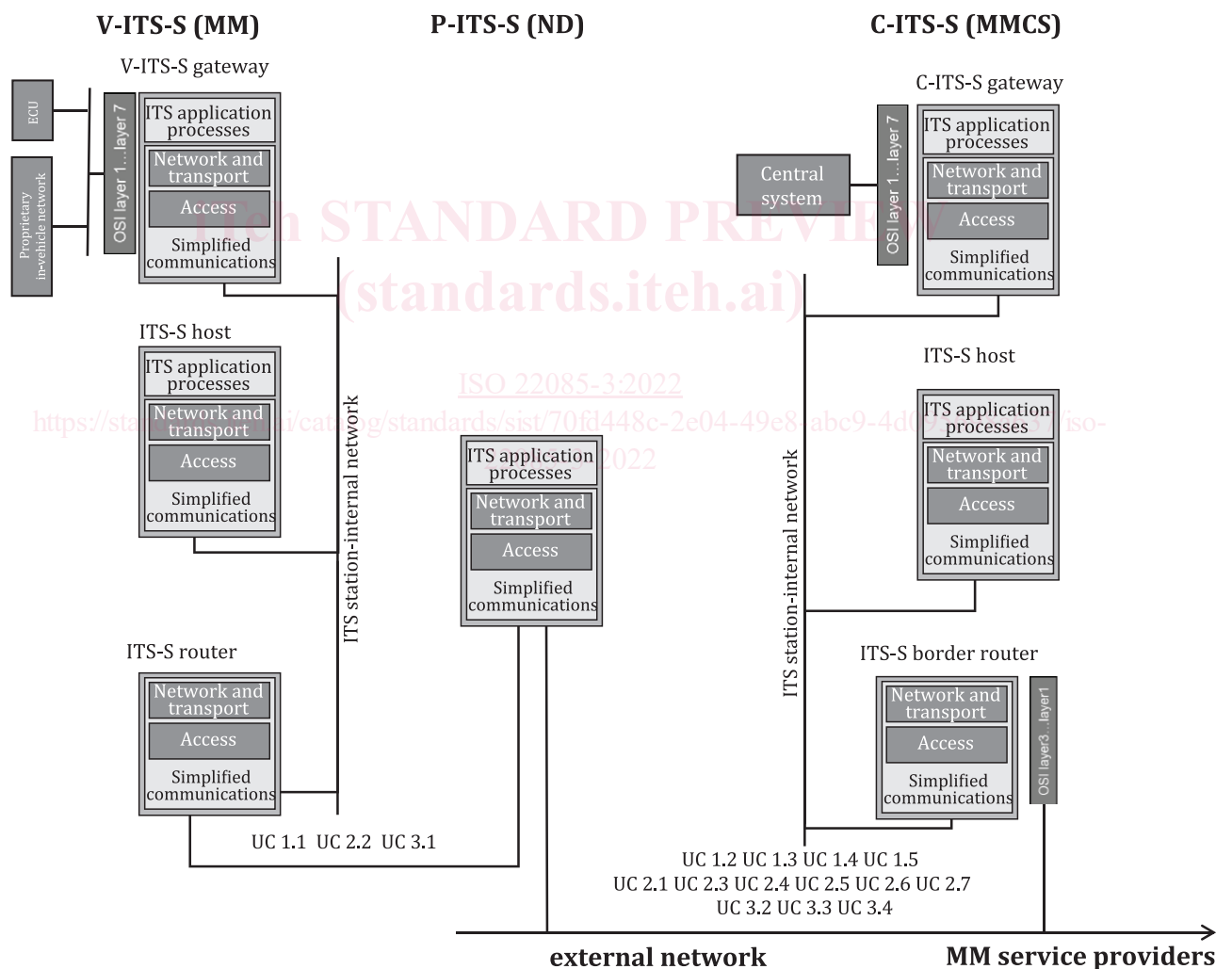


Figure 1 — Conceptual aspects of the general use cases

Table 1 — Use cases clusters and associated use cases overview

Title of use cases cluster	Brief description
1. Pre-trip	This cluster specifies the detailed use cases of pre-trip stage for MM. It includes 5 different use cases:

Table 1 (continued)

Title of use cases cluster	Brief description
	<ul style="list-style-type: none"> — UC 1.1 – MM information providing services — UC 1.2 – Navigation service linked information on charging station — UC 1.3 – Pre-scanning available parking space service — UC 1.4 – MM sharing service — UC 1.5 – MM as an integrated mobility service
2. En-route	<p>This cluster specifies the detailed use cases of the en-route stage for MM. It includes 7 different use cases.</p> <ul style="list-style-type: none"> — UC 2.1 – Traffic information providing service — UC 2.2 – MM status monitoring service — UC 2.3 – Mobile tolling service — UC 2.4 – Adaptive route management service — UC 2.5 – Searching available parking space service on the way — UC 2.6 – Keyless go service for shared micro mobility — UC 2.7 – Interconnected transfer information providing service
3. Post-trip	<p>This cluster specifies the detailed use cases of post-trip stage for MM. It includes 4 different use cases.</p> <ul style="list-style-type: none"> — UC 3.1 – MM driving information providing service — UC 3.2 – Charging station information service — UC 3.3 – Parked MM position providing service — UC 3.4 – Sharing MM return service

4.2 Message overview

DXMs regarding the use cases defined in ISO/TR 22085-1 are summarized in [Table 2](#).

Table 2 — DXMs for mobility service using MM

	ID	DXM name	Exe	Description
	1	request-mm-status	P	Request V-ITS-S to notify MM status with SOC, DTC, mileage, V-ITS-S-ID.
	2	mm-status-response	V	Send MM status information (V-ITS-S-ID, SOC, DTC, mileage) to P-ITS-S.
	3	stop-notify-mm-status	P	Stop sending MM status information to P-ITS-S.
	4	notify-mm-service	P	Send MM status information, V-ITS-S-ID, position and user information to C-ITS-S. After the first contact, send only the P-ITS-S position, MM status information and V-ITS-S-ID in a predefined time interval.
	5	stop-notify-mm-service	P	Stop the communication to the C-ITS-S.
	6	charging-station-information	C	Send charging station location to P-ITS-S.
	7	parking-space-information	C	Send parking location information to P-ITS-S.

Table 2 (continued)

	ID	DXM name	Exe	Description
	8	reservation-information	C	Send sharing service reservation information to P-ITS-S.
	9	public-transit-schedule	C	Send public transit information with arrival/departure time and transit type to P-ITS-S.
	10	public-transit-reserved-information	C	Send reserved information to P-ITS-S.
	11	navigation-route-information	C	Send navigation route information to P-ITS-S.
	12	traffic-information	C	Send traffic information to ND (P-ITS-S) from server (C-ITS-S).
	13	accident-information	C	Send accident information from server (C-ITS-S) to ND (P-ITS-S).
	14	danger-zone-information	C	Send danger zone location information to P-ITS-S.
	15	warning-message	C	Send warning message if DTC error has occurred.
	16	toll-balance-information	C	Definition of toll-balance-information.
	17	disconnection-warning-message	C	Send connection lost warning message where connection between V-ITS-S and P-ITS-S has been disconnected.
	18	return-information	C	Send returning MM information.
	19	payment-information	C	Send sharing service reservation information to P-ITS-S.
	20	request-public-transit-schedule	P	Send public transit schedule request from ND (P-ITS-S) to server (C-ITS-S).
	21	request-public-transit-reservation	P	Reserve public transit schedule from ND (P-ITS-S) to server (C-ITS-S).

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5 Data structure

5.1 Data structure for request-mm-status

Table 3 shows the data structure for the DXM request-mm-status to request MM status information and V-ITS-S ID from the ND (P-ITS-S).

Table 3 — Data structure for request-mm-status

Msg	ID	1	Request that V-ITS-S notifies MM status with SOC, DTC, mileage and V-ITS-S-ID.
	name	request-mm-status	
	exec	P-ITS-S	
Data structure	<div><div>request-mm-status</div><div>→ null</div><div>No dataset</div></div>		

5.2 Data structure for mm-status-response

Table 4 shows the data structure for the DXM mm-status-response to send MM status information to the ND (P-ITS-S).

Table 4 — Data structure for mm-status-response

Msg	ID	2	Send MM status information (V-ITS-S-ID, SOC, DTC, mileage) to the P-ITS-S
	name	mm-status-response	
	exec	V-ITS-S	
Data structure	<div>request-mm-status</div> <div>textString → V-ITS-S-ID</div> <div>group → MM status</div> <div>numeric2 → SOC</div> <div>enumString → DTC</div> <div>numeric4 → Mileage</div>		

5.3 Data structure for stop-notify-mm-status

Table 5 shows the data structure for the DXM stop-notify-mm-status to stop the communication from the vehicle (V-ITS-S).

Table 5 — Data structure for stop-notify-mm-status

Msg	ID	3	Stop sending MM status information to the P-ITS-S.
	name	stop-notify-mm-status	
	exec	P-ITS-S	
Data structure	<div><div>stop-notify-mm-service</div><div>→ null</div><div>No dataset</div></div>		

5.4 Data structure for notify-mm-service

Table 6 shows the data structure for the DXM notify-mm-service to send MM status information, V-ITS-S-ID, position, user information from the P-ITS-S to the C-ITS-S.

Table 6 — Data structure for notify-mm-service

Msg	ID	4	Send MM status information, V-ITS-S-ID, position and user information to the C-ITS-S. After the first contact, send only the P-ITS-S position, MM status information and V-ITS-S-ID in a predefined time interval.
	name	notify-mm-service	
	exec	P-ITS-S	
Data structure	<div><div>request-mm-status</div><div><div>textString</div><div>V-ITS-S-ID</div></div><div><div>group</div><div><div>MM status</div><div><div>numeric2</div><div>SOC</div></div><div><div>enumString</div><div>DTC</div></div><div><div>numeric4</div><div>Mileage</div></div></div></div><div><div>group</div><div><div>Position</div><div><div>numeric4</div><div>Latitude</div></div><div><div>numeric4</div><div>Longitude</div></div><div><div>numeric2</div><div>Elevation</div></div></div></div><div><div>group</div><div><div>Indoor position</div><div><div>numeric4</div><div>X-axis</div></div><div><div>numeric4</div><div>Y-axis</div></div><div><div>numeric4</div><div>Z-axis</div></div></div></div></div>		

5.5 Data structure for stop-notify-mm-service

Table 8 shows the data structure for the DXM stop-notify-mm-service to send MM status information, V-ITS-S-ID, position and user information from the P-ITS-S to the C-ITS-S.