



BSI Standards Publication

**Intelligent transport systems —
Cooperative systems — Data
exchange specification for
in-vehicle presentation of
external road and traffic
related data
(ISO/TS 17425:2016)**

National foreword

This Published Document is the UK implementation of CEN ISO/TS 17425:2016.

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**Intelligent transport systems - Cooperative systems - Data
exchange specification for in-vehicle presentation of
external road and traffic related data (ISO/TS
17425:2016)**

Systèmes intelligents de transport - Systèmes
coopératifs - Spécifications d'échange des données
pour la présentation dans le véhicule de la route
externe et des données relatives au trafic (ISO/TS
17425:2016)

Intelligente Transportsysteme - Kooperative Systeme -
Datenaustausch Spezifikation für die fahrzeuginterne
Darstellung von externen Straßen- und
verkehrsrelevanten Daten (ISO/TS 17425:2016)

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European foreword

This document (CEN ISO/TS 17425:2016) has been prepared by Technical Committee ISO/TC 204 “Intelligent transport systems” in collaboration with Technical Committee CEN/TC 278 “Intelligent transport systems” the secretariat of which is held by NEN.

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Endorsement notice

The text of ISO/TS 17425:2016 has been approved by CEN as CEN ISO/TS 17425:2016 without any modification.

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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).

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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*.

Introduction

Traditional fixed road signs are positioned on road verges to inform drivers about the applicable regulations, or to warn them about dangers or to provide them with other general information – this can be considered as roadside signage information. Beyond this fixed signage, the newer technologies have now allowed for some time for more accurate dynamic presentation of roadside signage information depending on the actual road and environmental conditions using variable or dynamic message signs. With the advent of Cooperative Intelligent Transport Systems (C-ITS) it is possible to provide more focused and timely guidance to vehicle controllers and drivers by supporting continuous presentation of the content of roadside signage information in the vehicle along the impacted road section rather than only during the short moments it takes for a vehicle to pass traditional road signs. Direct in-vehicle presentation of roadside signage information, called In-Vehicle Signage, facilitates the potential provision of information to specific classes or characteristics of vehicles, and for potentially more granular definition of affected road sections than stationary-position traditional fixed plate signs and use of variable/dynamic road signs. It does not deal with contextual speeds which are covered by ISO/TS 17426.

Delivering the In-Vehicle Signage service to road users can improve road safety, support traffic management, and reduce greenhouse gas emissions. It does not preclude other usage of the delivered information but such services are not in the scope of this Technical Specification.

All ITS services follow the same abstract process structure consisting of a sequence of detection (of an event) including pre-processing of the detected content, execution of the service algorithm (processing of detected content), and presentation or utilization of the service result. [Figure 1](#) (extracted from ISO/TS 17427) summarizes and details this process structure.

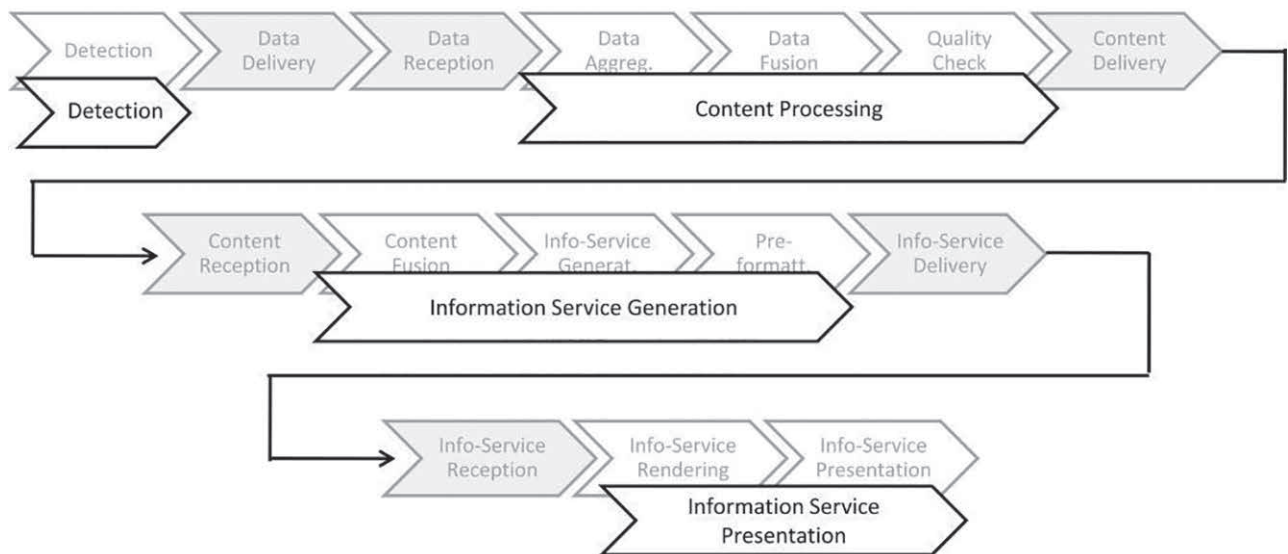


Figure 1 — General description of process for In-Vehicle Signage (from ISO/TS 17427:2014, Annex A)

Based on this abstract and general description of process steps in an ITS service, a large number of possible scenarios can be derived. This is true for In-Vehicle Signage. Every step in the process chain can be executed by different actors or stakeholders. Additionally, the execution of a process step for different spatial areas may be delivered by different actors. Each combination of different actors for different process steps can be used to identify distinct scenarios.

Assuming that there are two main stakeholder groups in C-ITS, the Infrastructure stakeholder and the Vehicle stakeholder, multiple combinations, and therefore multiple scenarios, are possible as every step might be delivered by either stakeholder group (see [Figure 2](#)) or shared between both stakeholder groups (see [Figure 3](#)).

	CONTENT	SERVICE	PRESENTATION		CONTENT	SERVICE	PRESENTATION
1	Vehicle	Vehicle	Vehicle	5	Infrastructure	Vehicle	Vehicle
2	Vehicle	Vehicle	Infrastructure	6	Infrastructure	Vehicle	Infrastructure
3	Vehicle	Infrastructure	Vehicle	7	Infrastructure	Infrastructure	Vehicle
4	Vehicle	Infrastructure	Infrastructure	8	Infrastructure	Infrastructure	Infrastructure

Figure 2 — Possible scenarios — Simple combinations

	CONTENT	SERVICE	PRESENTATION		CONTENT	SERVICE	PRESENTATION
9	Vehicle	Vehicle	Vehicle + Infrastructure	19	Vehicle + Infrastructure	Vehicle	Vehicle
10	Vehicle	Infrastructure	Vehicle + Infrastructure	20	Vehicle + Infrastructure	Vehicle	Infrastructure
11	Vehicle	Vehicle + Infrastructure	Vehicle + Infrastructure	21	Vehicle + Infrastructure	Vehicle	Vehicle + Infrastructure
12	Vehicle	Vehicle + Infrastructure	Vehicle	22	Vehicle + Infrastructure	Infrastructure	Vehicle
13	Vehicle	Vehicle + Infrastructure	Infrastructure	23	Vehicle + Infrastructure	Infrastructure	Infrastructure
14	Infrastructure	Vehicle	Vehicle + Infrastructure	24	Vehicle + Infrastructure	Infrastructure	Vehicle + Infrastructure
15	Infrastructure	Infrastructure	Vehicle + Infrastructure	25	Vehicle + Infrastructure	Vehicle + Infrastructure	Vehicle
16	Infrastructure	Vehicle + Infrastructure	Vehicle + Infrastructure	26	Vehicle + Infrastructure	Vehicle + Infrastructure	Infrastructure
17	Infrastructure	Vehicle + Infrastructure	Vehicle	27	Vehicle + Infrastructure	Vehicle + Infrastructure	Vehicle + Infrastructure
18	Infrastructure	Vehicle + Infrastructure	Infrastructure				

Figure 3 — Possible scenarios — Complex combinations

Every scenario is one specific of combination of stakeholders executing process steps. This Technical Specification addresses the scenarios where detection, content pre-processing, and the information service generation (see [Figure 1](#)) are delivered under the responsibility of the infrastructure stakeholder group (scenario 7 as seen in [Figure 2](#)). In scenario 7, the information service presentation takes place in the vehicle. Scenario 7 is considered in detail in this Technical Specification.

The defined C-ITS applications rely on the functionality and procedures defined within the Communications Architecture and by the reference ITS station architecture (as defined in ISO 21217 and other International Standards or Technical Specifications from the C-ITS standard set).

Annex A and Annex B contain profiles that define an instantiation for the IVS service. Annex A and Annex B contain conditional mandatory requirements. There is no need to comply with these requirements to claim compliance with this Technical Specification.

Annex A contains a profile that is communication technology agnostic. Annex B contains a profile that is focused on ITS-G5. For details on the referenced standards, see the introduction of the corresponding Annex.

These profiles are expected to be implemented and validated in European initiatives. Based on the results of these initiatives, it is intended to specify one interoperable solution in a future version of this Technical Specification.

Intelligent transport systems — Cooperative systems — Data exchange specification for in-vehicle presentation of external road and traffic related data

1 Scope

This Technical Specification specifies the In-Vehicle Signage service and application that delivers In-Vehicle Signage information to ITS stations (vehicle ITS stations or personal ITS stations devices) concerning road and traffic conditions, qualified by road authorities/operators, in a consistent way with road authority's/operator's requirements, in the manner that is coherent with the information that would be displayed on a road sign or variable message sign (VMS).

NOTE A Variable Message Sign is also named dynamic message sign. Both terms are considered as synonyms and can be used interchangeably. In the text below, only variable message sign and its abbreviated term VMS are used.

This Technical Specification defines the following:

- the In-Vehicle Signage service and the In-Vehicle Signage application that instantiates this ITS service;
- the requirements to be fulfilled by the In-Vehicle Signage service;
- the requirements for using functions provided by the ITS station facilities layer supporting the use of the In-Vehicle Signage service;
- the ITS-S application processes in the different ITS station, that instantiate the In-Vehicle Signage ITS service.

This Technical Specification also specifies: the sets of communication requirements and objectives (profiles) using the methods defined in ISO/TS 17423 to select the level of performance (best effort or real-time, etc.), confidence and security (authentication, encryption, etc.) for each communication flow between ITS stations in the scope of the In-Vehicle Signage service.

This Technical Specification defines the selection of relevant functions and procedures provided by the ITS station facilities layer (ISO/TS 17429) and defines the message structure, content, syntax, atomic elements to be used by the In-Vehicle Signage application.

NOTE This application is colloquially called “In-Vehicle Signage”.

The In-Vehicle Signage service includes the on-board information management. This management ensures contextual coherence of the end-user ITS service (e.g. vehicle characteristics, message priority, etc. avoiding amongst others things the presentation of conflicting information to end-users).

The production of information supporting the In-Vehicle Signage application, its qualification, and its relevance are out of the scope of this Technical Specification.

This Technical Specification does not specify the design of in-vehicle Human Machine Interfaces (HMI), but it does specify requirements that such interfaces shall be capable of supporting in order to permit the correct dissemination and use of information provided by the In-Vehicle Signage service.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 639-1, *Codes for the representation of names of languages — Part 1: Alpha-2 code*

ISO 3166-1, *Codes for the representation of names of countries and their subdivisions — Part 1: Country codes*

ISO 21217, *Intelligent transport systems — Communications access for land mobiles (CALM) — Architecture*

ISO/TS 14823, *Traffic and travel information — Messages via media independent stationary dissemination systems — Graphic data dictionary for pre-trip and in-trip information dissemination systems*

ISO/TS 16951, *Road vehicles — Ergonomic aspects of transport information and control systems (TICS) — Procedures for determining priority of on-board messages presented to drivers*

ISO/TS 17423, *Intelligent transport systems — Cooperative systems — ITS application requirements and objectives for selection of communication profiles*

ISO/TS 17429, *Intelligent transport systems — Cooperative systems — Profiles for processing and transfer of information between ITS stations for applications related to transport infrastructure management, control and guidance*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 21217, ISO/TS 17423, ISO/TS 17429, and the following apply.

3.1 additional service

IVS service able to deal with the lower levels of message priority

3.2 communication authority

entity in charge of regulating telecommunications and/or broadcast services

3.3 core service

IVS service able to deal with the two highest levels of message priority

3.4 driver awareness zone DAZ

parts of road network on which a message is present to inform drivers about upcoming situations

3.5 HMI control unit

in-vehicle device that manages prioritisation and presentation of messages designed for consumption by vehicle occupants

3.6 in-vehicle signage in-vehicle signage service IVS

ITS service that provides receiving ITS stations in order to inform drivers about static as well as dynamic road signs and variable message signs

3.7

IVS application

ITS-S application process that instantiates the IVS service

3.8

IVS application service provider

application service provider

service provider

entity that executes the corresponding ITS service

Note 1 to entry: According to ISO/TS 17427, its role can be defined as collecting the content that is required to run the IVS service, running the IVS service and providing a suitable service response.

3.9

IVS content service provider

content service provider

content provider

source of the *in-vehicle signage* (3.6) information

Note 1 to entry: According to ISO/TS 17427, its role can be defined as providing the information content for the IVS service.

3.10

IVS message

message generated for the *in-vehicle signage* (3.6) ITS service as specified in this Technical Specification

3.11

IVS receiving ITS station

ITS station that receives and processes the *IVS messages* (3.10)

Note 1 to entry: It can be either a vehicle ITS-S or a personal ITS-S.

3.12

IVS sending ITS station

ITS station that generates and transmits the *IVS messages* (3.10)

Note 1 to entry: It can be either a central ITS-S or a roadside ITS-S.

3.13

minimum dissemination area

MDA

parts of the road network where the *IVS message* (3.10) can be received by the potentially targeted vehicles

3.14

qualified information

information issued by authorised sources (road authorities, traffic managers) for their operated network

3.15

relevance zone

RZ

parts of the road network for which the *IVS message* (3.10) is valid

3.16

traffic manager

entity in charge of operating a road network and managing traffic

Note 1 to entry: For this Technical Specification, this entity is also considered as an enacting road authority; although in some circumstances, these different activities can be operated by separate entities.

3.17
validity end time
STO

time from which the *IVS message* (3.10) shall no longer be presented

3.18
validity start time
STA

time from which the *IVS message* (3.10) shall be presented

4 Symbols and abbreviated terms

ADU	Application data unit
BSMD	Bounded secured managed domain
C-ITS	Cooperative intelligent transport systems
C-ITS-S	Central ITS station
DAZ	Driver awareness zone
DMB	Digital multimedia broadcast
DMS	Dynamic message sign
HMI	Human machine interface
ICT	Information and communication technologies
ITS	Intelligent transport systems
ITS-S	ITS station
ITS-SU	ITS station unit
ITS-SCU	ITS station communication unit
IVS	In-Vehicle Signage
LDM	Local dynamic map
MDA	Minimum dissemination area
P-ITS-S	Personal ITS station
R-ITS-S	Roadside ITS station
RZ	Relevance zone
STA	Validity start time
STO	Validity end time
TCC	Traffic control centre
TMC	Traffic management centre

NOTE 1 TCC and TMC are considered as synonyms and can be used one interchangeably. In the text below, TCC will be used.

V-ITS-S	Vehicle ITS station
VMS	Variable message sign

NOTE 2 VMS and DMS are considered as synonyms and can be used interchangeably. In the text below, VMS will be used.

5 Service definition and main concepts

5.1 General

The IVS service aims to provide information to road users from an authorized IVS content provider presented in the vehicle in a manner that is consistent with that of VMS or road signs. This information

is provided to drivers aiming to improve road safety, reduce environmental impact, and enhance traffic flow.

NOTE 1 The information conveyed within an IVS message is the information that is available on fixed road signs on roadside or on a VMS.

NOTE 2 In most circumstances, the IVS information is expected to be qualified by road authorities/operators, in a consistent way with road authority's/operator's requirements, in the manner that is coherent with the information that would be displayed on a road sign or a variable message sign (VMS).

Traffic information is presented automatically or at the request of the user.

Where possible, it is presented in the vehicle in a language chosen by the end-user.

NOTE 3 Such an ITS service is relevant when driving a terrestrial road vehicle but not for pedestrians. When in this Technical Specification it is said of vehicle it does not imply the ITS service is only based on Vehicle ITS-station. It may also be operated with a personal ITS-station present in a vehicle. In both cases, the information is presented to the driver through an adapted HMI.



Figure 4 — Example of dynamic message display

Every IVS message presented from the In-Vehicle Signage service can depict either a road sign or a variable message sign. Annex C provides some background information on road signage and Annex D on VMS technologies.

The static information on static road signs and VMS is managed through catalogues. There are two levels of pictogram catalogues:

- a) the international level through the Convention on road signs and signals (also known as the Vienna convention - UNECE) used in around 100 countries;
- b) the national level (generally defined through regulations) (like e.g. in France: Regulation of 1967).

NOTE 4 For countries having signed and ratified the Vienna convention, the national level is mainly based on this convention and only presents minor differences with the convention content. There may also be some slight differences regarding the used pictograms among countries for the same meaning.

NOTE 5 They allow independence between the content and its restitution. It needs to be updated when necessary.

Within IVS, messages are being defined including a priority scheme for HMI usage within the IVS service. Messages are being delivered to the HMI module, how the information is presented to the driver is the responsibility of the equipment supplier. Information covered by the primary services should be handled in the HMI with higher priority resulting in presentation to the driver in the driver awareness zone at least once.

Overall priority cannot be determined by a single ITS service. This is dependent on the context and all active ITS services inside the vehicle.

NOTE 6 The importance of high quality and safe HMI is recognized. However, as stated in [Clause 1](#), HMI is out of the scope of IVS. IVS will be one of the ITS services/ITS applications available in-vehicle. How these ITS applications will work together in a harmonized manner is not specified in this Technical Specification.

5.2 Service definition

5.2.1 Definition

The In-Vehicle Signage ITS service supports the provision of information from an ITS-station to another ITS-station concerning either static or dynamic information about traffic conditions and traffic regulations. In countries where it is allowed, it can also include not directly traffic-relevant messages that can be displayed on variable message signs. The information is provided by traffic managers or authorized content providers to drivers seeking improved road safety, reduced environmental impact, and enhanced traffic flow.

NOTE The information is provided via a central or roadside ITS-station to another ITS-station located in a vehicle. Other schemes are possible such as messages hopping between ITS-stations in vehicles. This information is available on fixed road signs or variable message signs (VMS) on the roadside or mounted above specific lanes.

5.2.2 Message categories

The “In-Vehicle Signage” ITS service implements the following two message categories that are considered as part of service levels:

- a) higher priority messages associated with core services (see [5.2.3](#));
- b) lower priority messages associated with additional services (see [5.2.4](#)).

5.2.3 Core services

The core services implement the following two message types:

- a) Immediate danger warning message type: a warning alert concerning a danger involving drivers’ or other users’ safety.

NOTE 1 According to the UNO convention on traffic signs and signals (known as the Vienna convention), such warning messages are provided using either triangle-shaped or diamond-shaped signs depending on convention choices in specific countries.

NOTE 2 Typically on motorways or dual carriageway roads presentation of immediate danger warning messages is given at this distance between 2 km and 5 km from the danger, this varies according to national or regional rules. On other roads and in urban areas, this distance is typically shorter.

- b) Regulatory message type: prohibition, restriction, obligation or special regulation (that may depend on the vehicle type), compulsory routes, and rerouting.

NOTE 3 Regulatory messages are subject to relevant local/national legislation enacted by and recognized in law. Such regulatory messages may be relevant to specific classes of vehicle, driver qualifications, vehicle loads, environmental conditions, etc.

NOTE 4 According to the UNO convention on traffic signs and signals (known as the Vienna convention), such prescriptions are generally provided using round-shaped signs.

5.2.4 Additional services

Secondary services are related to messages of more general interest. Secondary services implement one or several of the following message types:

- a) Traffic-related information message type: events (that do not create not immediate dangers), driving conditions, forecasts (for traffic congestion, weather, events), travel time, advisory alternate route, etc.
- b) Pollution message type: there are commonly two forms of such messages: information messages and warning messages. Both forms of message exclude driving prohibitions or obligations which are part of core service.
- c) Not traffic-related information message type including but not limited to examples such as abduction alerts also sometimes called “amber alert”.

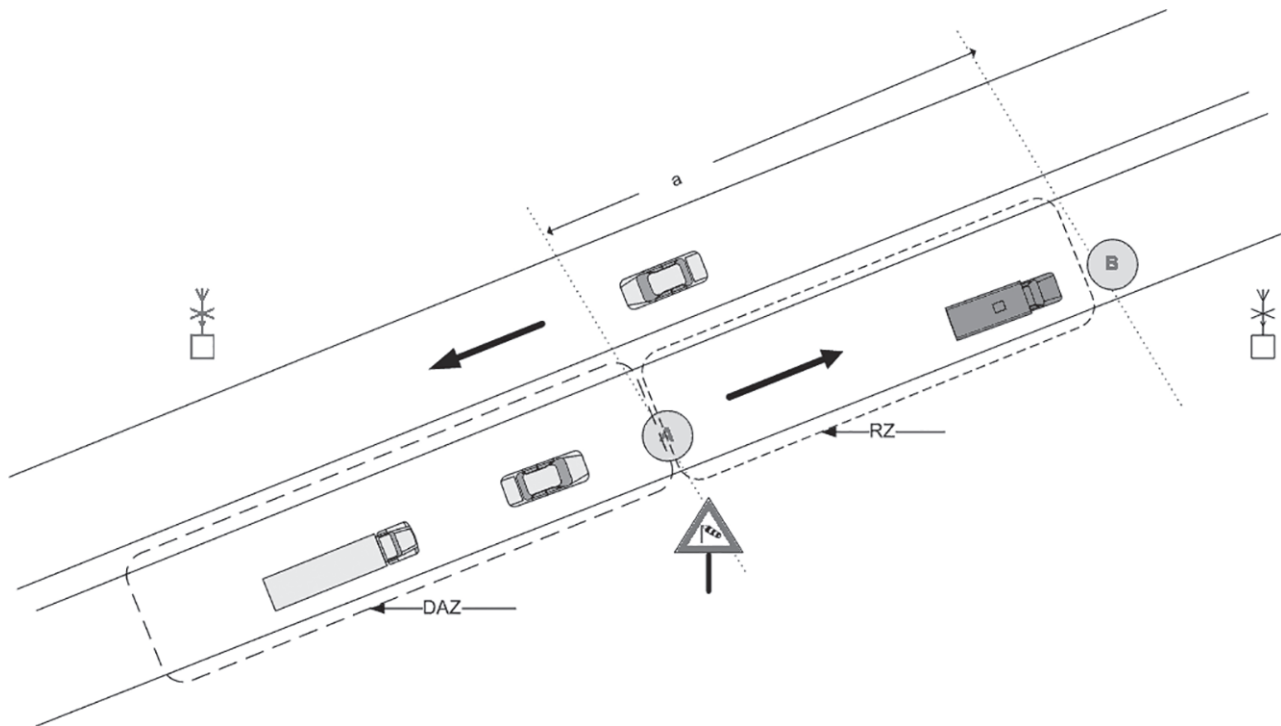
5.3 Fundamental parameters

5.3.1 Spatial relevance

Two fundamental parameters characterize an IVS message spatially that are:

- Relevance zone (RZ) which is defined by the parts of road network for which the IVS message is valid.
- Driver awareness zone (DAZ) which is defined by the parts of road network before entering the relevance zone, allowing presentation of the corresponding message to the driver in advance of entering the Relevance zone.

The two parameters are illustrated in [Figure 5](#) below.



Key

RZ relevance zone

DAZ driver awareness zone

a The relevance of the information that would be displayed on a road sign (or VMS) extends from A to B.

Figure 5 — Fundamental spatial parameters for IVS

NOTE 1 RZ or DAZ can be of length null (i.e. featured as a point). In the case where DAZ is of length null, it may be omitted.

NOTE 2 The DAZ of an IVS message can also include more than one road element where this message is also pertinent for drivers (modifying their route, etc.).

Annex E provides some information on the RZ topology for the road signs defined in the Vienna convention.

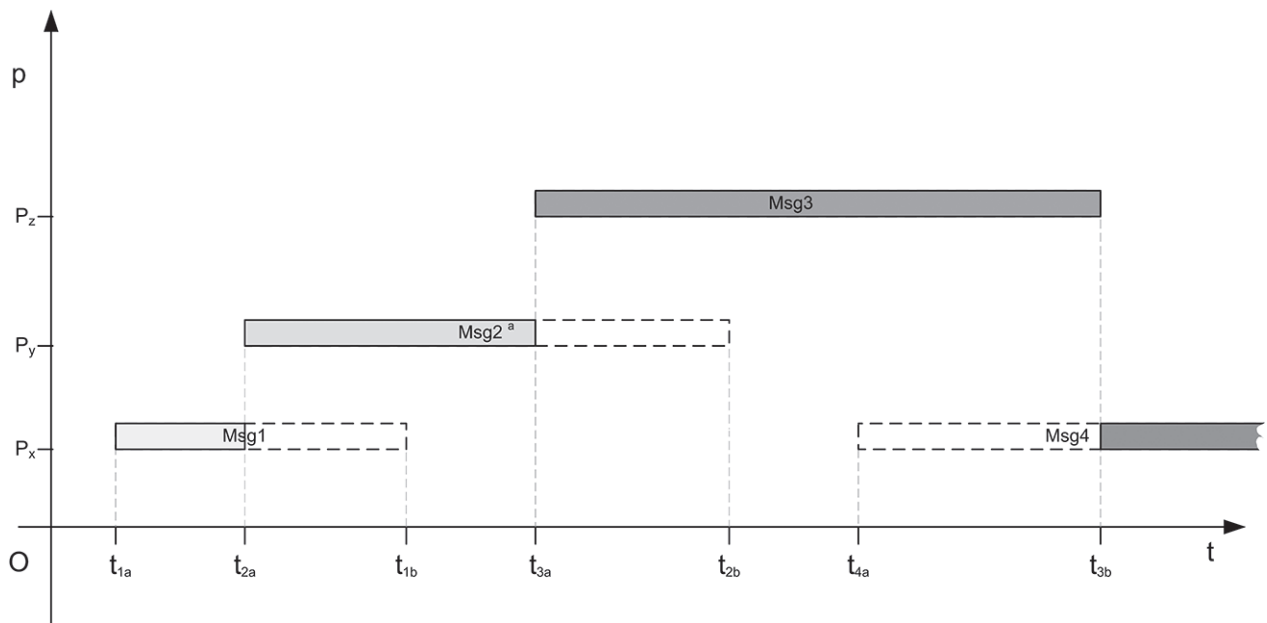
Minimum dissemination area (MDA) is defined by the area covering the minimum parts of the road network where an IVS message shall be transmitted for receipt by the potentially targeted vehicles.

5.3.2 Temporal validity

To characterize the temporal validity of an IVS message, two fundamental parameters are defined:

- validity start time (STA) which is the time from which the IVS message is valid;
- validity end time (STO) which is the time from which the IVS message is no longer valid.

A driver can successively meet along his/her route several road signs or VMS which can have overlapping RZ and different priority levels. [Figure 6](#) presents an example of such a case.



Key

- t time scale (t_{1a} , t_{1b} , t_{2a} , ... represent different periods of time), e.g. Msg1 is valid between t_{1a} and t_{1b}
- p priority level scale (p_x , p_y , p_z represent different levels of IVS message priority)
- a The plain part of each bar represents when a message is transmitted to the HMI unit, whereas the dashed part represents when the message is stored in the receiving ITS-S and not transmitted to the HMI unit.

Figure 6 — Temporal relevance of several IVS messages

NOTE Temporal validity is an absolute concept based on a timeline whereas the spatial relevance is relative to the vehicle location, vehicle heading, and other vehicle characteristics.

5.3.3 Other parameters

Other parameters are to be taken into account when determining which vehicles and drivers are targeted such as vehicle characteristics, driver's licence status, weather conditions, etc.

5.4 Example of system implementation

5.4.1 General description

[Figure 7](#) illustrates an example of a possible system architecture implementing the IVS service.

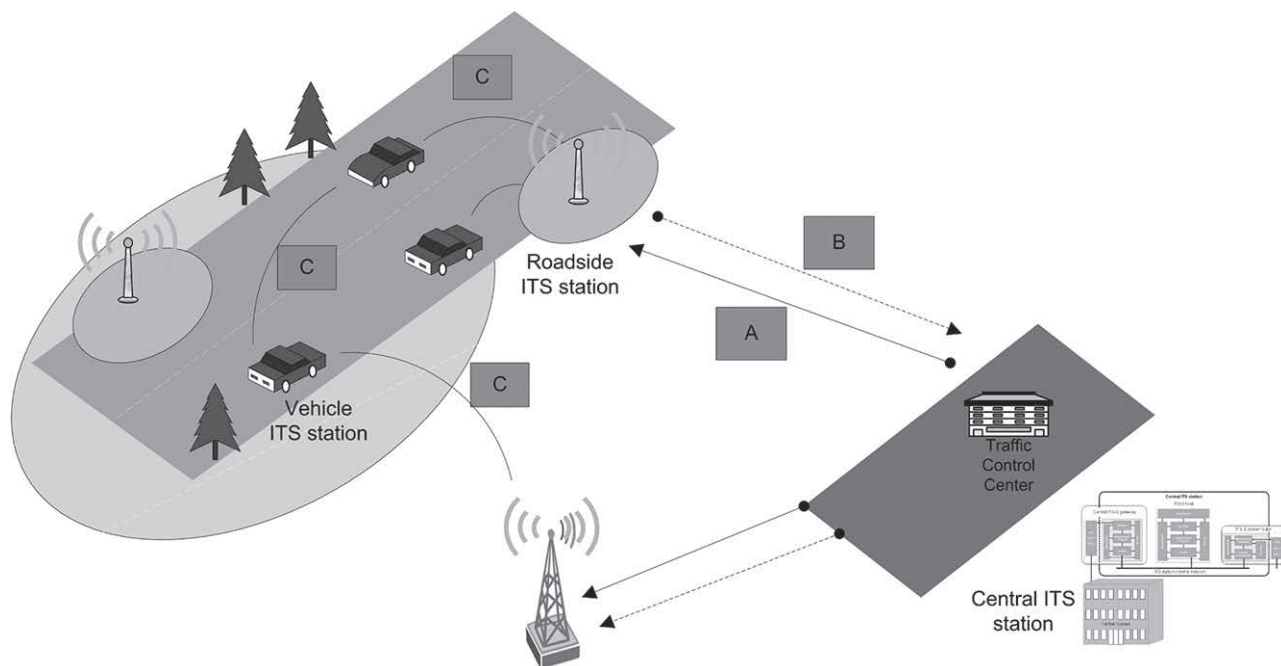


Figure 7 — Example of system architecture

5.4.2 Interface identification

The main interfaces are depicted on the figure above as follows.

A: Update of the IVS message by central ITS station (traffic management centre, WEB server, Mobility server, etc.)

B: Verification of the IVS messages being broadcasted

C: Broadcasting of IVS messages to in-vehicle ITS Stations

NOTE 1 The update and verification of an IVS message may be also achieved by a local personal ITS-S (smartphone, USB key...etc.).

NOTE 2 Other interfaces can also be considered according to the choice made by the road/traffic operator.

6 Roles and responsibilities

6.1 Scenarios for In-Vehicle Signage

This subclause describes system operation including provision of content, provision of service, and provision of presentation. In the next subclauses, the different scenarios for In-Vehicle Signage are described based on the general scheme as presented in [Figure 8](#).

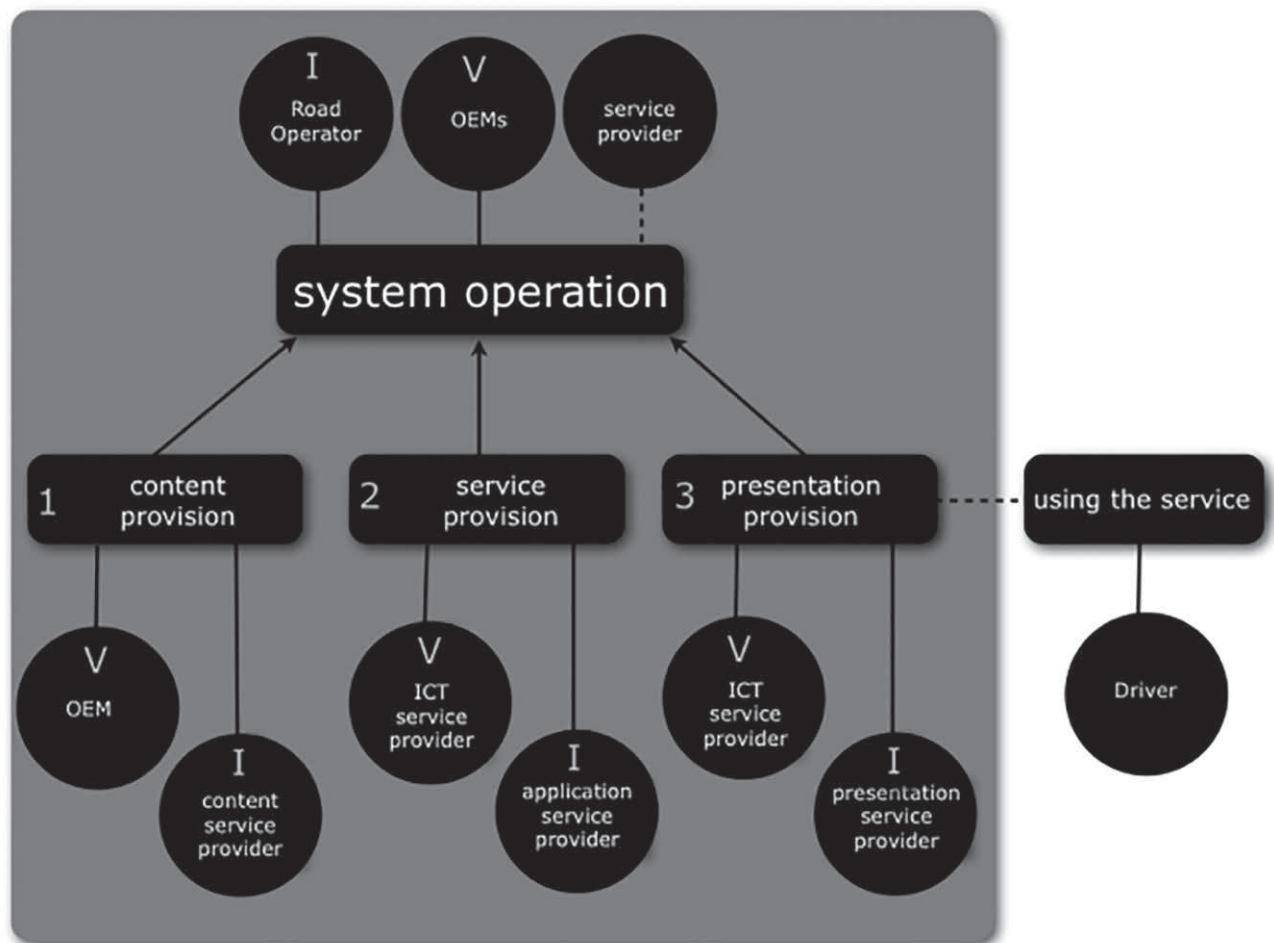


Figure 8 — General roles and actors for In-Vehicle Signage

In [Figure 8](#), the character “V” in balloons in the figure stands for actor(s) responsible for the vehicle and/or nomadic devices in the vehicle (V-ITSS, P-ITSS). The character “I” in balloon stands for actor(s) responsible for the roadside infrastructure, e.g. the central ITS-station of a Traffic Control Centres (C-ITSS) or roadside ITS-stations (R-ITSS).

The roles are split into two levels, on the high level is the role Service provision. This can be fulfilled by actors from “V” and/or “I”. For “I”, the responsibility will be with the traffic manager; for “V”, the responsibility will be determined by OEMs.

NOTE 1 Service providers probably will be involved in the future.

The role “System operation” is split up in the roles Content Provision, Service provision, and Presentation Provision.

NOTE 2 A detailed description of the different roles and their relationships can be found in ISO/TS 17427.

According to the general description of the service, the focus is set on scenario I-I-V, [Figure 8](#). For this scenario, the responsible actor for the role of system operation probably will be the actor responsible for the roadside infrastructure (I). The responsibility might be shared with the actor responsible for the vehicle (V) – this is illustrated by the dashed line.

NOTE 3 As explained in the Introduction of this Technical Specification, it can be named “scenario 7”.

NOTE 4 The notation used in the different figures of [Clause 6](#) is explained in an informative annex of ISO/TS 17427.

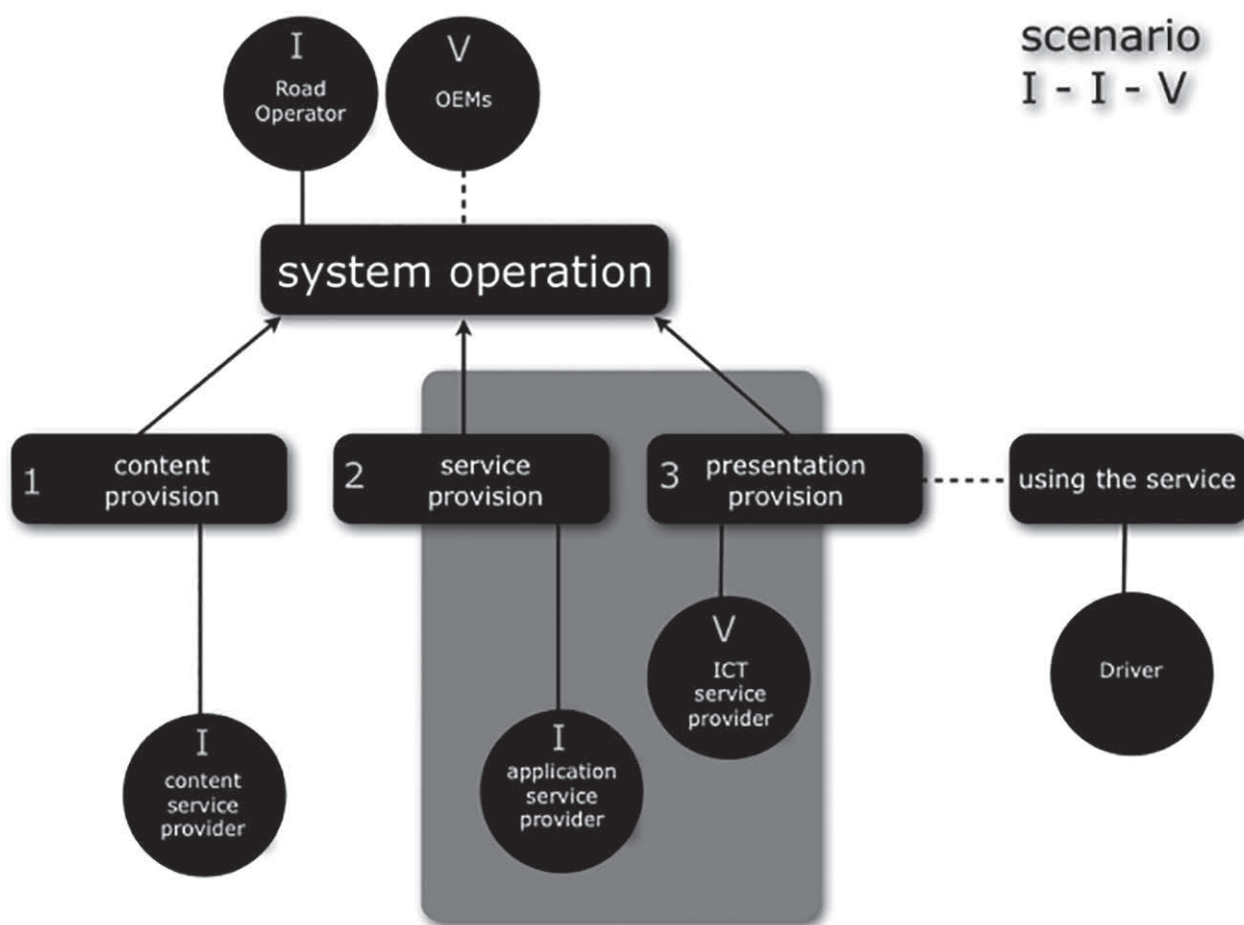


Figure 9 — Roles and actors for In-Vehicle Signage — Scenario I-I-V

The actor responsible for the role of content provision is the content service provider from the field of roadside infrastructure.

The actor responsible for the role of service provision is the application service provider from the field of roadside infrastructure.

The actor responsible for the role of presentation provision is the ICT service provider from the vehicle side.

6.2 System operation roles in scenario I-I-V

For In-Vehicle Signage, [Figure 10](#) details the service provision onwards.

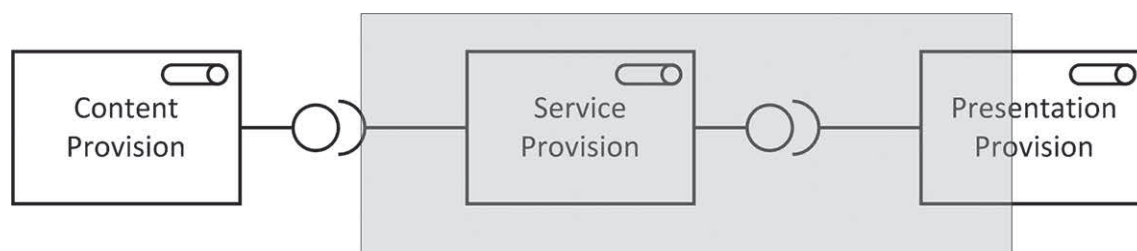


Figure 10 — Focus of In-Vehicle Signage — Process level

The grey box in [Figure 10](#) indicates the focus of In-Vehicle Signage put on process level. It is assumed that the content production is done according to specifications (e.g. national standards/regulations), which are not part of the scope of this Technical Specification. Therefore, it only considers roles and responsibilities for content, service, and presentation provision.

There is also a more technical communication level that needs attention. [Figure 11](#) shows the relation between service provision and communication management, as well as the presentation provision.

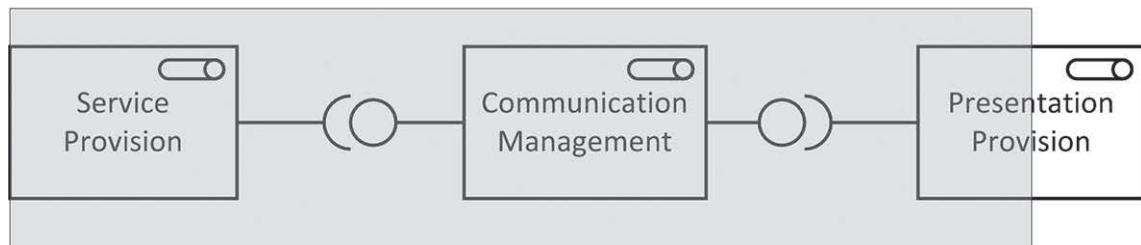


Figure 11 — Communication management

6.3 Possible actors in In-Vehicle Signage

For In-Vehicle Signage, two technical implementations are foreseen: long-range and short-range communications. The following two pictures show the possible actors for both implementations.

For illustrative purposes, [Figure 12](#) shows a possible implementation using a range of long-range communications (3G, 4G, DAB, etc.). There is a wide-area communication operator providing the communication means. Therefore, the role Communication Management is fulfilled by the wide-area communication operator.

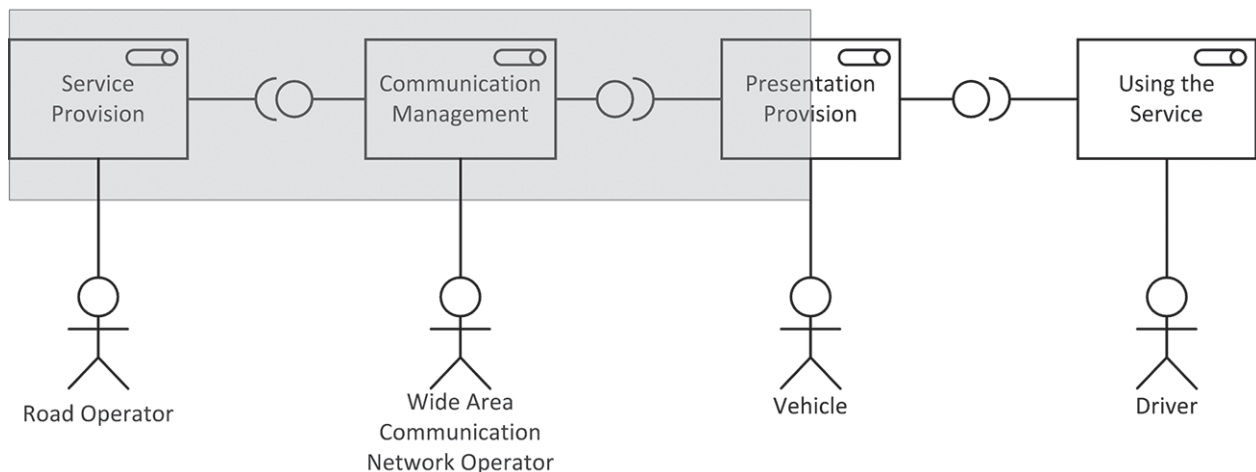


Figure 12 — Assignment of actors in case of usage of wide-area communications

[Figure 13](#) shows a possible implementation using short-range communication (e.g. G5). Short range communication makes use of ad hoc networks. There is no separate entity for operating these networks. Therefore, the parties involved in these ad hoc networks share the role of “Communication Management”. In this case, the actor responsible for “Service Provision” has a second role: “Communication Management”. The same applies for “Presentation Provision”.

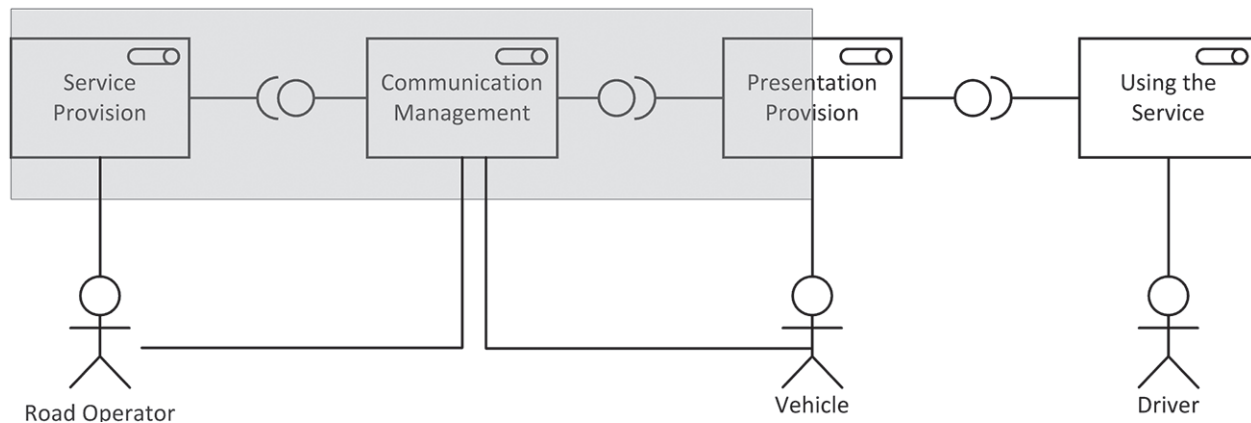


Figure 13 — Assignments of actors in case of usage of local area communications

Although the responsibility of the presentation is within the vehicle, rules and regulations applicable need to be considered. The responsibility for these regulations is within the role of the policy framework.

7 Requirements and recommendations

7.1 General

The requirements defined in the following subclauses are not directly dedicated to a type of equipment, but are applicable to the ITS service in operation and consequently to the ITS applications instantiating it. Some general requirements cannot be tested using mechanisms such as defined in the ISO/IEC 9646 series. However, functional requirements are also relevant because they structure the ITS service and the ITS applications with it.

The In-Vehicle Signage service shall comply with the applicable national regulations of the country/region where it is operated.

7.2 General requirements

The In-Vehicle Signage service, its messages, and their content are designed to be used for receipt of IVS information into vehicles. This design foresees the In-Vehicle Signage service being supported by the use of either a vehicle ITS-S, or a personal ITS-S, that is being used for receiving IVS information and processing for using the IVS service. These are collectively referred to as IVS receiver ITS station.

GR010: The In-Vehicle Signage service shall be able to provide information on one or more road signs or the multi-part content of traffic Variable Message Signs as defined by the choice of the Content Provider.

GR020: The minimum level of service for In-Vehicle Signage service shall include the core services (message types 1 and 2), as defined in [5.2.3](#).

GR030: All ITS applications instantiating the IVS service shall comply with this Technical Specification.

GR040: The versions of the implemented IVS application and of the data structures used for the service shall be identified.

7.3 Message content

CR010: If present, the coding of road signs or pictograms used in a Variable Message Sign that is encoded in an IVS message shall be done using ISO/TS 14823.

CR020: The IVS message shall contain identification of the Content Provider.

CR030: The IVS message shall contain a unique identifier in order to support message management.

CR040: The IVS message shall provide an appropriate message type (priority), as defined level in [5.2.3](#) and in [5.2.4](#).

CR050: The IVS message shall be structured such that it can contain text in multiple languages.

CR060: The IVS message shall provide information on any limitations to relevance defined by vehicle characteristics, vehicle class, vehicle usage, and road user profile if the IVS message contains such limitations.

CR070: The IVS message shall include the information on its relevance zone where it is relevant, driver awareness zone. In the case where DAZ is of length null, it can be omitted in the IVS message.

NOTE 1 For the definition of these concepts, see [5.3.1](#).

NOTE 2 Where appropriate, the relevance zone and driver awareness zone may define specific road elements and/or lanes.

CR080: Where appropriate, the relevance zone should contain information on the impacted traffic direction(s) and lane(s).

NOTE 3 The location of the vehicle is also to take into account when defining the priority rules of message presentation. Indeed, during a journey, a driver will be able to meet a significant number of VMS displaying information of operation action. RZ and/or DAZ of these messages may overlap. The vehicle location gives a priority weight for each message.

CR090: the IVS message should contain information on the validity start time and, when available, information on the validity end time.

CR100: In an IVS message, the language used for textual message parts (e.g. the free text content displayed on a Variable Message Sign) shall be identified in accordance with ISO 639-1.

CR110: Where appropriate, when dimension specific attributes are included in the IVS message, an indication of the measurement unit being used shall be provided.

NOTE 4 In the United Kingdom, the United States of America, and some other countries, speed information is given in miles per hour. In other European countries, speed information is provided in kilometres per hours. When numeric values are supplied, the associated units of measurement need to be defined. Similarly, by way of an example, vehicle length limitation is given in metres in Europe, whereas it is given in feet and inches in USA.

CR120: In case of full-matrix signs or assimilated (like rotating prisms sign), where there is no other possibility to describe the content in terms of data elements, the content can be encoded as a compressed JPEG file.

NOTE 5 This possibility is reserved for very exceptional cases.

7.4 Message management requirements

7.4.1 IVS sending ITS station requirements

MR010: The Service Provider responsible for distributing IVS messages to IVS receiver ITS station shall be authorized and provide authentication.

MR020: The IVS sending ITS station allocates a unique message identifier and a message generation time in combination for each IVS message that it generates.

MR030: The IVS message unique identifier shall be retained for IVS messages relating to the same sign or Variable Message Sign locations, i.e. different displayed signs at the same location showing a change in status of, say, road surface conditions, changing traffic conditions, etc. The IVS message generation time is used to time-stamp different versions of related messages.

MR040: Where updated information is available about signs or Variable Message Sign content that is distributed via IVS messages from an IVS sending ITS station, the updated information shall be distributed in an IVS message with the same identifier as earlier related IVS messages.

MR050: The IVS message generation time shall relate to the time that a first version of an IVS message is generated. Only when different and updated information is distributed shall the message generation time be updated. In the case of resending of the same message content, without change, the message generation time shall not be updated.

MR060: When IVS information is no longer valid or the situation leading to signage is no longer present or considered significant by the Content Provider, a specific IVS cancellation message with the same identifier as earlier related IVS messages shall be created.

NOTE This possibility is reserved for very exceptional cases.

MR070: When IVS information is considered as ended or foreseen to end at a given time by the Content Provider and this information was not provided previously, a specific IVS end message with the same identifier as earlier related IVS messages shall be created.

MR080: On creation of an IVS message, the Content Provider shall provide information in the message itself about its relevance and validity (validity status, start of the period of validity, end of the period of validity if available, applicability of the information with respect to vehicle types, vehicle characteristics, vehicle usage, or vehicle driver profiling).

7.4.2 Roadside ITS station

MR090: Roadside ITS station shall broadcast all of the valid IVS messages.

NOTE IVS messages are considered to be valid when (1) the current time of the roadside ITS Station is greater or equal to the validity start time of the IVS message to be distributed; and (2) that the current time of the roadside ITS Station is less than or equal to the validity end time of the IVS message to be distributed, when it exists.

7.4.3 IVS receiving ITS station requirements

MR100: The IVS receiving ITS station shall determine if the received IVS information is relevant taking into account the driving direction. It also should take into account where it is provided, the carriageway, the lane used, and the vehicle characteristics.

MR110: The IVS receiving ITS station shall check the validity times contained in the received IVS message and check if the current time in the IVS receiving ITS station is not greater than the Validity End Time of that IVS message, where it is provided.

MR120: If the Content Provider or Service Provider is not authenticated and/or authorized, the corresponding IVS message shall be cancelled at the IVS receiving ITS station.

MR130: The IVS receiving ITS station shall retain IVS message information as long as the Validity End Time of the message has not been passed. It should retain the IVS message information as long as this ITS station is located in the relevance zone or if passed in a given time defined by a system parameter.

MR140: The IVS receiving ITS station shall update the retained IVS message information when an IVS message having the same identifier and later message generation time is received. Only the last version of an IVS message is stored under the conditions defined in MR150.

MR150: The IVS receiving ITS station shall remove IVS message information when the cancellation message having the same identifier and later message generation time is received.

MR160: The IVS receiving ITS station shall remove IVS message information when the end message having the same identifier and later message generation time is received. If a validity end time is provided with the end message, the removal of the message only occurs when the validity end time has been passed.

MR170: The IVS receiving ITS station shall remove IVS information once the pre-determined period of time defined by a system parameter after having received the last message has elapsed, where the IVS service is operated on a broadcast basis (repetition rate defined).

7.4.4 Transmission of IVS information to the HMI control unit

MR180: The IVS receiving ITS station shall transmit valid and relevant received IVS message content to the HMI control unit.

NOTE 1 The corresponding presentation is safely made when driving according to HMI regulations and standards.

MR190: Noting the conditions given in the requirement below, the IVS receiver ITS station shall transmit the received IVS message content to the HMI unit if the current time of the IVS receiver ITS station is equal or greater than the IVS message validity start time and the current time of the IVS receiver ITS station is less than or equal to the IVS message validity end time.

In cases where no validity end time has been provided for an IVS message and the message validity is not given as permanent, the IVS message can be considered to be valid during the period from the start of validity to the time of receipt of the IVS message at the IVS receiving ITS station plus a duration defined by a system parameter.

MR200: If the type of vehicle to which the IVS message content applies does not correspond to the indicated type of vehicle of the IVS receiver ITS station, this IVS message shall not be transmitted to the HMI unit.

MR210: If the current location of the IVS receiver ITS station is not located in the relevance zone or driver awareness zone as defined by the IVS message content, this IVS message shall not be transmitted to the HMI unit.

MR220: If the traffic direction for which the IVS message is applicable does not correspond to the current driving direction of the IVS receiver ITS station, the message shall not be transmitted to the HMI unit.

MR230: The message shall be transmitted to the HMI control unit when the IVS receiver ITS station enters the DAZ (or if null or omitted, RZ).

NOTE 2 The message may be stored into the vehicle long before and transmitted only when the vehicle enters the driver awareness zone.

MR240: The message shall be transmitted to the HMI control unit, according to priority management rules, when the message validity start time has been passed.

MR250: The messages that are not presented shall not be cancelled. The IVS application shall carry out a new analysis on the stored messages to assess whether one needs to be transmitted to the HMI control unit when an IVS message is no longer valid or has been given as removed of the HMI control unit.

NOTE 3 This requirement is justified by the IVS message hierarchy (see [5.3.2](#)).

MR260: The different IVS messages shall be transmitted to the HMI control unit according to the following decreasing priority order based on the IVS message type:

- a) immediate danger warning messages;
- b) regulatory messages;
- c) traffic-related information messages;
- d) pollution messages;
- e) not traffic-related information messages.

NOTE 4 The exact definition of the message types is provided in [5.2.3](#) and in [5.2.4](#).

This priority management only deals with IVS messages. When required, it is possible to explicitly override this priority level and therefore to allocate a higher level priority to an IVS message.

7.5 Recommendations for information processing in relation with the presentation to vehicle drivers

Successful use of the IVS services depends upon relevant IVS information being presented to vehicle drivers in a suitable, appropriate, proportionate, non-distracting manner. The design of the IVS application, as defined in this Technical Specification, supports a range of contextual information for transmission from the infrastructure to the vehicle that indicates the relevance, validity, and priority of IVS information, besides the IVS content itself. There is the strong desire for the IVS information to be presented in the correct context and therefore appropriate use of this contextual information via the HMI unit is strongly recommended. The scope of this Technical Specification does not include the design or functionality of HMI units.

PR010: Every IVS message should be presented in an unambiguous way so that it can be easily distinguished by a driver from any other message.

PR020: When the HMI unit allows for highlighting IVS messages, this should be consistent with the choice of the Content Provider to highlight the IVS message or not.

PR030: For languages where the writing directionality is variable, the IVS message should be presented using the text direction defined by the Content Provider.

NOTE 1 This requirement is defined for accommodating the different cases of text directionality. Some languages can be written horizontally, others vertically. For some specific languages, the same text can be written either horizontally or vertically according to the choice made by the Content Provider. As well, the horizontal text direction may change from left-to-right to right-to-left when the text is written vertically instead of horizontally.

PR040: An IVS message has a defined priority. The IVS application should respect the priority of IVS messages provided for presentation., such that IVS message whose type is 1 or 2 (primary services) or which are overridden shall have priority for presentation before IVS messages whose type is higher (i.e. greater than 2 – secondary services).

PR050: The HMI should allow the user to know if the IVS service is available or not.

NOTE 2 This is particularly important when the IVS service available has nothing to present to make the distinction between the case the IVS service is not available and the case when the IVS service is available with no information to report.

PR060: The dynamic status of the vehicle should be taken into account before presenting the IVS message. It is up to the receiver ITS-S to decide on whether to transmit information or not to the HMI unit.

EXAMPLE 1 The driver of a vehicle in a traffic jam or on a service area will not need the same information that in a moving vehicle.

PR070: A driver should be able to select a preferred language and national road sign catalogue. If the preferred language or national road sign catalogue does not contain appropriate entries to enable reliable translation of the IVS message content in the preferred choices of the vehicle driver, the information should be presented in the form and language of the IVS sending ITS Station.

PR080: The catalogue in force in a country/region should be downloaded when crossing a border if it is not present in the IVS receiver ITS-S for this specific country/region.

EXAMPLE 2 In case of the European Union, there are 28 official national catalogues.

PR090: The catalogue should include the pictograms of road signs used in the country/region and the reference VMS layout(s) adopted in the considered country/region.

PR100: The HMI should be able to present the different components of a message displayed on a traffic sign or variable message sign as decided by the content provider.

PR110: The corresponding reference layout of VMS content or of a full-matrix sign should be provided.

PR120: This defined priority management only deals with IVS messages. In case of concurrence between different ITS services, the presentation should be carried out according to ISO/TS 16951 specifications.

Annex A (informative)

Profile 1

A.1 General

ISO standards allow specifying ITS applications agnostic to the communication technology actually used and available. The benefits of the ISO standards (ISO 21217, ISO/TS 17423, ISO 24102-2, ISO 24102-6, ISO/TS 17429...) for IVS and other ITS applications are the following.

- The IVS message can be transmitted using any available communication protocol stack available on the ITS station [ETSI BTP/G5, ISO/P1609 (harmonization on-going), UDP/IP] and thus using any available access technology (vehicular Wi-Fi, urban Wi-Fi, cellular, satellite, infrared, Li-Fi, ...).
- The IVS message can be transmitted in different ways, either
 - broadcast from a roadside ITS station to vehicle ITS stations using vehicular Wi-Fi (802.11p),
 - end-to-end from a central ITS station directly to subscribed vehicle ITS stations and personal ITS stations (for instance using the cellular network), and
 - end-to-end from a central ITS station to relay that simply broadcast to vehicle ITS stations and personal ITS stations (e.g. using urban Wi-Fi access points, satellite or digital radio).
- The IVS services can easily be deployed in areas where there is no roadside infrastructure deployed using 802.11p or to drivers who do not yet have an on-board vehicle ITS station equipped with 802.11p.

This Annex specifies a profile for the instantiation of the IVS service largely based on the following standards developed by ISO:

- ISO 21217 for ITS station architecture;
- ISO/TS 17419 for classification and management of ITS applications in a global context;
- ISO/TS 17423 for ITS application requirements for automatic selection of communication interfaces;
- ISO/TS 17429 for ITS station facilities for the transfer of information between ITS stations;
- ISO/TS 18750 for the global concept of local dynamic map;
- CALM standards such as ISO 24102 series.

This Annex describes the following:

- the relationships existing between these different standards ([A.2](#));
- specific additional requirements added to the requirements defined in [Clause 7](#), especially for communications ([A.3](#));
- the functional data model for the IVS service using UML (Annex F);
- the corresponding data dictionary (classes, attributes, and enumerations) ([A.5](#));
- the ASN.1 message structure ([A.6](#) and [A.7](#));
- the normative references used in this Annex.

A.2 Relationship with others standards

The architecture of the ITS station (ITS-S) specified in ISO 21217 is illustrated in [Figure A.1](#).

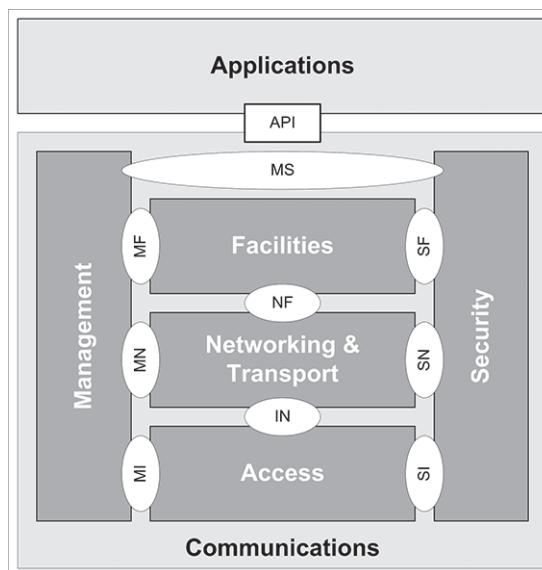


Figure A.1 — Simplified ITS-S reference architecture (from ISO 21217)

The IVS service is provided to users by execution of the IVS application. This application is an instantiation of the IVS service that involves the association of complementary ITS-S application processes.

In order to be able to install and execute these ITS-S application processes in an ITS-S unit (ITS-SU) operated as a Bounded Secured Managed Domain (BSMD) as specified in ISO 21217, the registration procedures identified in ISO/TS 17419 is applied.

The IVS application requires communications between these ITS-S application processes residing in ITS-SU units. Such communications include the exchange of IVS Messages.

In order to enable communications between ITS-S application processes residing in different ITS-S Communication Units (ITS-SCU), prior to transmission of application data units (ADUs) each ITS-S application process registers at the ITS-S management entity and presents its communication requirements as specified in ISO/TS 17423. Required values to be presented for the ITS-S application processes of the IVS application are specified in [A.3.5](#).

Upon this registration and presentation of communication requirements, the ITS-S management will identify the most appropriate communication profile for each source of data and assign a “FlowID” to it as specified in ISO 24102-6.

Communications require features of the ITS-S facilities layer both for transmission and for reception of ADUs as specified in ISO/TS 17429.

The IVS application requires that their related ITS-S application processes provide received geo-referenced and time-stamped information to a Local Dynamic Map (LDM) specified in ISO/TS 18750, when a LDM exists. The LDM is the key element to enable cooperative behaviour in an ITS-SU, i.e. the sharing of data between applications.

The IVS application requires retrieving LDM data elements either by a subscription mechanism or by a query mechanism, as specified in ISO/TS 18750.

The IVS application is uniquely identified by the registered “ITS Application Identifier” (ITS-AID) as specified in ISO/TS 17419.

The IVS application uses predefined messages from the ITS Message Set IVS. The ITS message set IVS is uniquely identified by the registered “ITS Message Set Identifier” (ITS-MsgSetID) specified in ISO/TS 17419. The values of ITS-AID and ITS-MsgSetID are assigned by the respective registration authority. The numbering of messages in this ITS Message Set is as uniquely defined for this IVS Message Set.

A.3 Additional requirements

A.3.1 General requirements

GR050: The In-Vehicle Signage service shall comply with the communications architecture and use of ITS stations as defined in ISO 21217.

A.3.2 Service security requirements

SR010: C-ITS-S and R-ITS-S shall be registered in accordance with the requirements of ISO/TS 17419 to have the right to broadcast IVS messages.

SR020: The ITS-AID (Application Identifier) for this application shall be provided by the registration authority according to ISO/TS 17419.

SR030: IVS messages received by an IVS receiver ITS station shall be safe and secured according to relevant information security standards.

A.3.3 Case of central ITS station

MR270: Except for IVS messages directly generated by a Roadside ITS station, all other IVS message shall be generated by the Content Provider at a Central ITS station and shall be communicated from the Central ITS station to the Roadside ITS station. The Roadside ITS station shall only distribute such a received IVS message once receipt of that IVS message by the Roadside ITS station has been acknowledged towards the originating Central ITS station.

MR280: Except the case where information IVS messages are being created locally by a roadside ITS station, to improve alignment of information provision from multiple sources, central ITS stations(s) shall provide the roadside ITS station with all necessary information related to the IVS application, using the methods specified in ISO/TS 17419.

A.3.4 Message handling using a LDM

If the IVS receiving ITS station uses a LDM specified by ISO/TS 18750, the requirements in this Annex shall apply.

MR290: All IVS messages shall be recorded in the LDM of IVS receiver ITS station according to the specifications of ISO/TS 18750.

MR300: The IVS messages in LDM of IVS receiver ITS station shall be accessed for updating their content according to the specifications of ISO/TS 18750.

MR310: The IVS messages in LDM of IVS receiver ITS station shall be accessed for reading according to the specifications of ISO/TS 18750.

MR320: The IVS messages in the LDM of IVS receiver ITS station shall be deleted according to the specifications of ISO/TS 18750.

A.3.5 Communication requirements

A.3.5.1 Overall and common requirements

The In-Vehicle Signage service, like other ITS services, requires communication between ITS stations. Several communication flow types are identified. Each communication flow type has specific and different communication requirements. These communication requirements shall be provided to the ITS station management entity using the methods specified in ISO/TS 17423 and ISO 24102-6.

Each ITS-S application process shall register at the ITS-S management entity and present its communication requirements as specified in ISO/TS 17423.

The following annexes introduce identified flow types, the actions to be taken by the ITS application processes to provide the requirements and objectives defined below to other ITS-S entities, and the communication values for each flow type.

NOTE This is done for each communication flow type.

A.3.5.2 The different communication flows

IVS requires communication between ITS stations; five communication flow types are identified:

- a) flow for high priority broadcast service communication: the roadside ITS-S broadcasts high priority messages to passing IVS receiving ITS stations (e.g. via an IEEE 802. 11p communication interface);
- b) flow for low priority broadcast service communication: the roadside ITS-S broadcasts low priority messages to passing IVS receiving ITS station (e.g. via an IEEE 802. 11p communication interface);
- c) push service communication flow: the central ITS-S sends point-to-point messages (unicast) to subscribed IVS receiving ITS station application processes (e.g. via a cellular network or an urban WiFi 802.11n communication interface);
- d) configuration service communication flow: the roadside ITS-S is managed and configured remotely from the central ITS-S (e.g. via an optic fibre, satellite, or a cellular communication interface);
- e) catalogue service communication flow: the central ITS-S sends point-to-point catalogue information (unicast) to subscribed IVS receiving ITS station application processes (e.g. via a cellular network or a DAB/DMB communication interface).

A.3.5.3 ITS-S application process actions

TR010: For each communication flow type, the ITS-S application process shall present its communication requirements and objectives to the ITS-S management entity using the methods described in ISO/TS 17423.

TR020: The minimum dissemination area shall be configured in such a way every receiving ITS-S has reasonable opportunity to receive at least once the corresponding IVS message before it enters or remains in DAZ (or if null or omitted, RZ) of the message during the validity time of the message.

NOTE According to the communication means used, such a requirement will be fulfilled differently.

A.3.5.4 Communication flow type requirements

[Table A.1](#) provides the values of the communication flow requirements for the broadcast service communication flow of the ITS-S application in an R-ITS-S.

Table A.1 — Flow 1. High priority broadcast service communication flow type requirements

Requirement	Value	Comment
Operational Requirements		
LogicalChannelType-Req^a	SfCH	Safety channel
ContConnect-Req	n.a.	No continuous connectivity
NxRepeat-Req	255, 1s	Repeat at 1 Hz until flow is cancelled or ended
Destination Requirements		
DestinationType-Req	geo-location-based GeoBroadcast	
DestinationDomain-Req	site-local ^b	
CommDistance-Req	n.a.	
Directivity-Req	n.a.	
Performance Requirements		
Resilience-Req	n.a.	
MinThP-Req	n.a.	
MaxLat-Req	n.a.	
MaxADU-Req	<max message size>	
Security Requirements		
Authentication-Req	required	
Encryption-Req	n.a.	
NonRepudiation-Rule	required	
Protocol Requirements		
Protocol-Req	n.a.	
^a Requirements in bold correspond to mandatory requirements, whereas the others are optional (source: ISO/TS 17423).		
^b See definition in ISO 24102-6 and ISO/TS 17423.		

[Table A.2](#) provides the values of the communication flow requirements for the broadcast service communication flow of the ITS-S application in an R-ITS-S.

Table A.2 — Flow 2. Low priority broadcast service communication flow type requirements

Requirement	Value	Comment
Operational Requirements		
LogicalChannelType-Req^a	SCH	Service channel
ContConnect-Req	n.a.	No continuous connectivity
NxRepeat-Req	255, 1s	Repeat at 1 Hz until flow is cancelled or ended
Destination Requirements		
DestinationType-Req	geo-location-based GeoBroadcast	
DestinationDomain-Req	site-local ^b	
CommDistance-Req	n.a.	
Directivity-Req	n.a.	
Performance Requirements		
Resilience-Req	n.a.	
MinThP-Req	n.a.	
^a Requirements in bold correspond to mandatory requirements, whereas the others are optional (source: ISO/TS 17423).		
^b See definition in ISO 24102-6 and ISO/TS 17423.		

Table A.2 (continued)

Requirement	Value	Comment
MaxLat-Req	n.a.	
MaxADU-Req	<max message size>	
Security Requirements		
Authentication-Req	required	
Encryption-Req	n.a.	
NonRepudiation-Rule	required	
Protocol Requirements		
Protocol-Req	n.a.	
^a Requirements in bold correspond to mandatory requirements, whereas the others are optional (source: ISO/TS 17423).		
^b See definition in ISO 24102-6 and ISO/TS 17423.		

[Table A.3](#) provides the values of the communication flow requirements for the push service communication flow of the ITS-S application in a central ITS-S, a vehicle ITS-S, and a personal ITS-S.

Table A.3 — Flow 3. Push service communication flow requirements

Requirement	Value	Comment
Operational Requirements		
LogicalChannelType-Req^a	GPCH	General purpose channel
ContConnect-Req	n.a.	No continuous connectivity
NxRepeat-Req	n.a.	No repetition
Destination Requirements		
Destination-Type-Req	address-based unicast	
DestinationDomain-Req	global	
CommDistance-Req	n.a.	
Directivity-Req	n.a.	
Performance Requirements		
Resilience-Req	Required	ACK preferred
MinThP-Req	n.a.	
MaxLat-Rea	n.a.	
MaxADU-Req	<max message size>	
Security Requirements		
Authentication-Req	required	
Encryption-Req	n.a.	
NonRepudiation-Rule	required	
Protocol Requirements		
Protocol-Req	n.a.	
^a Requirements in bold correspond to mandatory requirements, whereas the others are optional (source: ISO/TS 17423).		

[Table A.4](#) provides the values of the communication flow requirements for the configuration communication flow of the ITS-S application in a central ITS-S and a roadside ITS-S.