TECHNICAL SPECIFICATION

ISO/TS 19468

Second edition

Intelligent transport systems — Data interfaces between centres for transport information and control systems — Platform-independent model specifications for data exchange protocols for transport information and control systems

Systèmes de transport intelligents — Interface de données entre centres pour les systèmes de commande et d'information des transports — Spécification du modèle indépendant de plateforme pour les protocoles d'échange de données pour les systèmes de commande et d'information des transports

PROOF/ÉPREUVE

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Foreword

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

This second edition cancels and replaces the first edition (ISO/TS 19468:2019), which has been technically revised.

The main changes are as follows:

— UML Communication diagrams have been improved (introduction of Agents and Interfaces to define actor subsystems interactions and addition of subclause 5.8 to describe UML modeling methodology adopted);

— Void input parameter has been defined;

— Description of FEP+EP implementation has been improved with appropriate normative language;

— Publish Subscrube Exchange Pattern has been removed;

— Collaborative Intellignet Transport Systems (ITS) services requirements and features have been reviewed and added in Clause 5 and Annexes B and E;

— Collaborative ITS service FEP+EP PIM description has been introduced in Clauses 10 and 11;

— Annex C has been reviewed, introducing new classes and attributes to support the implementation of features used in other exchange patterns;

— Annex H has been deleted;

— Certain figures have been improved.

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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

This document defines a common set of data exchange specifications to support the vision of a seamless interoperable exchange of traffic and travel information across boundaries, including national, urban, interurban, road administrations, infrastructure providers and service providers. Standardization in this context is a vital constituent to ensure interoperability, reduction of risk, reduction of the cost base, promotion of open marketplaces and many social, economic and community benefits to be gained from more informed travellers, network managers and transport operators.

Especially in Europe, delivering transport policy in line with the White Paper[13] issued by the European Commission requires co-ordination of traffic management and development of seamless pan European services. With the aim of supporting sustainable mobility in Europe, the European Commission has been supporting the development of information exchange mainly between the actors of the road traffic management domain for a number of years.

This document supports a methodology that is extensible.

To be able to successfully connect systems and start exchanging data in an interoperable and easy way, there is a need to describe and agree on how this exchange should be achieved. This is set out in a data exchange specification. Data exchange in different scenarios can have different needs and requirements. Therefore, several data exchange specifications can be needed.

Data exchange specifications need to address two main issues. Firstly, they model the stakeholders and actors involved in data exchange, each potentially in different roles, as well as abstract exchange patterns for their interactions. Secondly, they select a suitable implementation platform and clearly specify how the abstract scenarios and patterns are effectively implemented on this platform.

The diagram in Figure 1 shows such an abstract communication scenario from the perspective of a road operator who requires data exchange interfaces between the different components of its own operational systems, either between centre side components or between centre and field devices, but also to exchange information with other road operators or service providers.

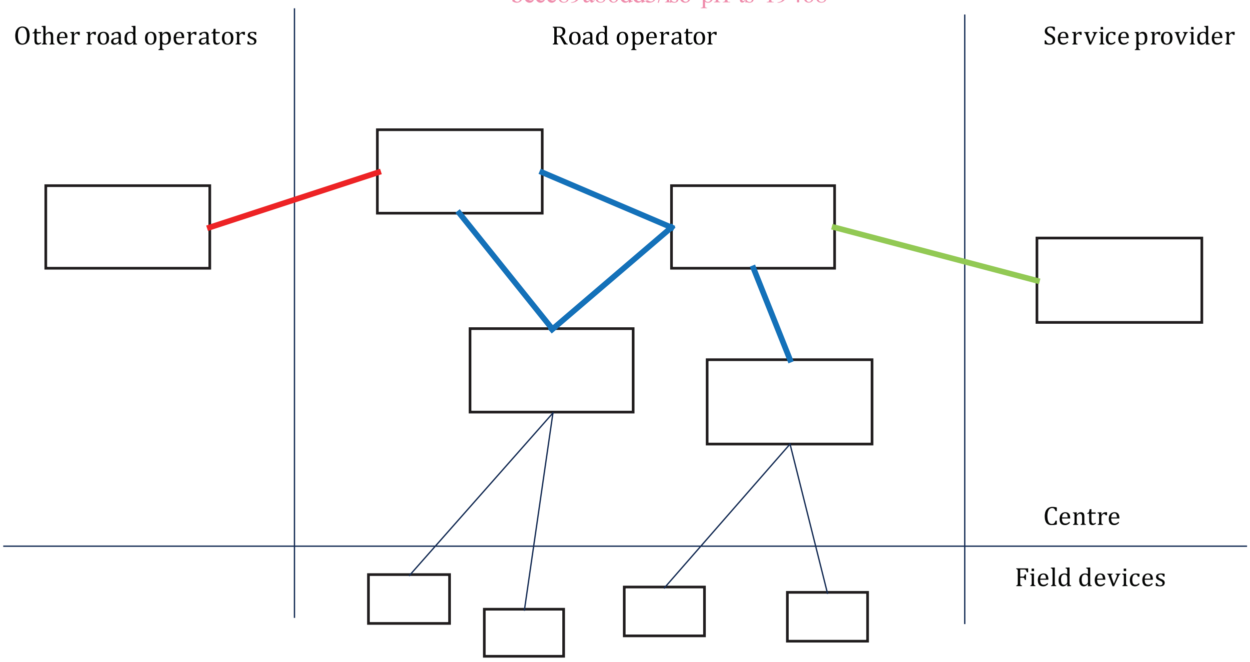

Figure 1 — Abstract communication scenario

While the black links between centre side components and field devices may use a variety of communication protocols, mostly depending on the physical link conditions, the vast majority of other coloured links between centre-side components, internal to one organization or external to others, is based on an IP network and mostly use the TCP transport layer protocol (UDP is also possible in a few cases).

Nevertheless, as the different colours indicate, they can very well have significantly different requirements. Internal links (blue) can reside in one domain of trust, hence do not require protocols compatible with security gateways. This can already be different for links to other road operators (red) and will certainly not hold for links to other types of organizations, like service providers, via the Internet (green).

While different security requirements offer the most striking and obvious example, there are more criteria that can lead to different preferences on different types of links, e.g. scalability, robustness and integration complexity.

In broad terms, the colours blue – red – green form a hierarchy from more internal, closely-coupled, well-integrated systems towards external, loosely-coupled and non-integrated systems. The world of information and communication technology (ICT) offers a broad range of solutions for these different scenarios, offering different advantages and disadvantages. It is clear that the one-size-fits-all principle will not provide the most efficient way of working here. Even on the highest level of abstraction and inside the ICT domain itself, a well-known battle of paradigms between remote-procedure-call (RPC) type service specifications and RESTful architectures exists. The same clusters of options are found in the domain of ITS standards, where for example the European standard for the real-time information interface relating to public transport operations (SIRI; see the EN 15531 series) introduces both concepts as complementary options: Publish-Subscribe and Request-Response.

Furthermore, the ITS station architecture is not in contradiction with this document but is complementary to what is defined in this document. According to the principles and the taxonomy defined in ISO 21217, this document defines a conceptual notion of:

— How two central ITS (sub) stations could communicate to:

  — deliver information (application data units),

  — negotiate functional service behaviour for collaborating traffic management functions (even if this use case could not directly be matched to ISO 21217 as it is not about information delivery).

— How a central ITS (sub-)station could communicate to deliver information (application data units) to another ITS station with the characteristics of a central ITS station.

This document specifies the process of defining the exchange characteristics by use case-driven feature selection of relevant parameters for the relevant OSI layers as defined in ISO 21217. Two exchange schemas are considered: Information delivery and Functional service negotiation between central ITS stations.

The drafting of this document was guided by the following principles:

— interoperability, such that different implementations can successfully engage in a data exchange process;

— supporting of legacy implementations which are based on existing (exchange) specification, in order to maximize investments already made by stakeholders;

— addressing other user profiles, not only road operators, thus making this document available to a broader audience;

— reusing existing (communications) standards, in order to reduce implementation complexity and take benefit of proven and already existing solutions for common ICT problems;

— maintaining a clear separation between the payload content and the exchange model.

Annex A details the adopted methodology for defining this exchange platform-independent model (PIM).

Intelligent transport systems — Data interfaces between centres for transport information and control systems — Platform-independent model specifications for data exchange protocols for transport information and control systems

1 Scope

This document defines and specifies component facets supporting the exchange and shared usage of data and information in the field of traffic and travel.

The component facets include the framework and context for exchanges, the data content, structure and relationships necessary and the communications specification, in such a way that they are independent from any defined technical platform.

This document establishes specifications for data exchange between any two instances of the following actors:

— Traffic information centres (TICs);

— Traffic control centres/Traffic management centres (TCCs/TMCs);

— Service providers (SPs).

This document can also be applied for use by other actors, e.g. car park operators.

This document includes the following types of information:

— use cases and associated requirements, and features relative to different exchange situations;

— different functional exchange profiles;

— abstract elements for protocols;

— data model for exchange (informational structures, relationships, roles, attributes and associated data types required).

In order to set up a new technical exchange framework, it is necessary to associate one functional exchange profile with a technical platform providing an interoperability domain where plug-and-play interoperability at technical level can be expected. The definition of such interoperability domains is out of scope of this document but can be found in other International Standards or Technical Specifications (e.g. the ISO 14827 series).

This document is restricted to data exchange. Definition of payload content models is out of the scope of this document.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

ISO and IEC maintain terminological 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
business scenario
high-level description of the interactions that can exist within a system being analyzed or between the system and external entities (called actors) in terms of business functions

Note 1 to entry: See also *use case* (3.20).

3.2
client
entity that receives the information

Note 1 to entry: It is represented in the information delivery *business scenario* (3.1).

3.3
exchange pattern
EP
basic exchange architecture template, described by UML communication diagrams, that identifies the actors in the exchange framework and the available interactions among them, which enable data exchange functionalities as a set of exchange features

Note 1 to entry: Exchange pattern interactions can be described by means of UML sequence diagrams and state machine diagrams in such a way that message-triggering conditions are fully identified and defined alongside any state update based on the subsequent interaction, i.e. exchanged messages and interaction-derived conditions.

3.4
collaborative ITS service
CIS
ITS service (3.7) that can be enabled by combing different "ITS services" that are provided by the combined effort of two to more stakeholders who can have different roles

EXAMPLE Traffic management centres, traffic information centres, service providers.

3.5
functional exchange profile
FEP
selection of data exchange features for a particular *business scenario* (3.1)

3.6
interoperability domain
pair of *functional exchange profile (FEP)* (3.5) and platform selected for implementing a data exchange subsystem

Note 1 to entry: Each *platform-specific model (PSM)* (3.11) document defines an interoperability domain, which ensures that two implementations of this PSM are interoperable and can successfully exchange *payload* (3.9).

3.7
ITS service
processing of information to address specific ITS requirements and implement ITS features such as to manage traffic or deliver information

3.8
payload content model
content model
UML definition of the data structures that can be used to describe travel and traffic information to be exchanged in an exchange system

3.9
payload publication
payload
bundle of information that is exchanged between two exchange systems containing an instance of the *content model* (3.8)

3.10
platform-independent model
PIM
document describing the abstract model of the standardized data exchange process in a platform-independent way

Note 1 to entry: This definition is specific to this document.

3.11
platform-specific model
PSM
document providing the implementation details of a *functional exchange profile (FEP)* (3.5) described in a *platform-independent model (PIM)* (3.10) for a concrete platform

Note 1 to entry: This definition is specific to this document.

3.12
profile-to-platform mapping
act of defining an *interoperability domain* (3.6)

3.13
pull exchange
exchange pattern (EP) (3.3) where the exchange of information is originated by the *client* (3.2)

3.14
push exchange
exchange pattern (EP) (3.3) where the exchange of information is originated by the *supplier* (3.20)

3.15
simple push
push-based *exchange pattern (EP)* (3.3) that does not require state to be maintained

3.16
snapshot
set of data providing all of the last known state as opposed to providing partial changes

Note 1 to entry: This definition is specific to this document.

3.17
snapshot pull
pull-based *exchange pattern (EP)* (3.3) where only the last *snapshot* (3.16) version is exchanged

3.18
snapshot push
push-based *exchange pattern (EP)* (3.3) where only the last *snapshot* (3.16) version is exchanged

3.19
stateful push
push-based *exchange pattern (EP)* (3.3) where data describing a communication session is maintained across successive communication within that session

3.20
supplier
entity that provides the information

Note 1 to entry: It is represented in the information delivery *business scenario* (3.1).

3.21
use case
UC
set of operational interactions between entities (called actors) and a system to ease understanding of the main functions behind such interactions

4 Symbols and abbreviated terms

ASN.1	Abstract Syntax Notation One
BUC	business use case
F&L	freight and logistic
HTTP	hypertext transfer protocol
ICT	information and communication technology
IP	internet protocol
ITS	intelligent transport systems
LOS	level of service
MDA	model-driven architecture
MMI	man-machine interface
pub/sub	publish-subscribe pattern
REST	representational state transfer
RPC	remote procedure call
SOAP	simple object access protocol
SSL	secure sockets layer
TCC	traffic control centre
TMC	traffic management centre
TIC	traffic information centre
TIS	traffic information service
TCP	transmission control protocol
TLS	transport layer security
TMP	traffic management plan
UDDI	universal description discovery and integration
UDP	user datagram protocol
UML	unified modeling language (see the ISO/IEC 19505 series)
VMS	variable message sign

W3C	world wide web consortium
WSDL	web service definition language
WSIL	web services inspection language
WSS	web services security
XML	extensible markup language

5 Exchange modeling framework

5.1 Overview

The model-driven approach is chosen to describe exchange: this leads to describing exchange systems by means of abstract models, named platform-independent models (PIMs), in which the modeling of exchange features is achieved by describing interactions among systems and subsystems as exchange patterns (EPs). These interactions implement system capabilities as features that fulfil exchange requirements requested by specific business scenarios which are used to describe specific uses of exchange.

5.2 Business scenarios and functional exchange profiles

This document is based on business scenarios, i.e. a high-level description of the interactions that can exist within a system being analyzed or between the system and external entities (called actors) in terms of business functions. Business scenarios are derived from application requirements on useful business information required and on technical capabilities enabled by available technologies. FEPs are identified to ensure interoperable services with the restriction of determining one FEP per business scenario for a specific EP, which is an abstract model of available technical platforms.

One business scenario can be supported by more than one FEP. FEPs can be enabled by several EPs (Figure 2).