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Intelligent transport systems (ITS) — Data exchange involving roadside modules communication —

Part 3: Application profile-data exchange (AP-DATEX)

Systèmes intelligents de transport (SIT) — Échange de données impliquant la communication par modules en bordure de route —

Partie 3: Profil d'application-échange de données (AP-DATEX)

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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

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

ISO 15784-3 was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*.

ISO 15784 consists of the following parts, under the general title *Intelligent transport systems (ITS) — Data exchange involving roadside modules communication*:

— *Part 1: General principles and documentation framework of application profiles*

— *Part 3: Application profile-data exchange (AP-DATEX)*

Introduction

The functional requirements for communication between a traffic management centre and roadside modules used for traffic management are varied because internationally there are many kinds of roadside modules for traffic management, such as signal controllers, dynamic message signs and vehicle detectors. In the development of standards for data exchanges between a traffic management centre and roadside modules used for traffic management, ISO/TC 204/WG9 agreed that the concept of a single standard for all countries and devices might not be appropriate, but a set of standards for different types of roadside module might be more appropriate.

As a result, ISO/TC 204/WG9 adopted the philosophy of producing profile documents to specify how data should be exchanged.

In the development of this part of ISO 15784, reference was made to the existing standards about profiles, specifically NTCIP 8003 which is the US standard for a profile framework, and ISO/IEC TR 10000, which is a series of Technical Reports under the general title *Information technology — Framework and taxonomy of International Standardized Profiles*.

The purpose of a profile is to specify the use of one or more base standards to provide a requested function. Because there are multiple functional requirements to data exchange between a centre and the roadside modules, ISO 15784 defines multi-part profiles.

This part of ISO 15784 defines only the application profile. End application data is defined in the data-registry. Each country should define lower layer profiles based on the internationally standardized protocols because each country has its own circumstance on communication infrastructure.

Intelligent transport systems (ITS) — Data exchange involving roadside modules communication —

Part 3:
Application profile-data exchange (AP-DATEX)

1 Scope

The purpose of this part of ISO 15784 is to define an application profile referring ISO 14827 and other base standards.

The application profile specified in this part of ISO 15784 is used to exchange data and messages in the following cases.

a) Between a traffic management centre and roadside modules for traffic management.

b) Between roadside modules used for traffic management.

The scope of this part of ISO 15784 does not include the communication between roadside modules and in-vehicle units, in-vehicle communication, in-cabinet communication or motion video transmission from a camera or recorded media.

2 Normative references

The following referenced documents are indispensable for the application 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/IEC 8825-1:2002, *Information technology — ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER) — Part 1*

ISO/IEC TR 10000-2:1998, *Information technology — Framework and taxonomy of International Standardized Profiles — Part 2: Principles and Taxonomy for OSI profiles*

ISO 14827-2:2005, *Transport information and control systems — Data interfaces between centres for transport information and control systems — Part 2: DATEX-ASN*

3 Terms and definitions

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

3.1
application layer
layer containing all functions needed for the distributed applications and not already provided by the presentation service

NOTE The application layer constitutes layer 7 of the OSI model.

3.2
base standard
approved international standard or a related authoritative standard

3.3
Basic Encoding Rules
BER
standardized determination of data encoding to conform to the requirements of ISO 8824, ASN.1

NOTE The Basic Encoding Rules are given in ISO 8825.

3.4
centre
computer or network that is required to meet a standardized communications interface over a fixed-point communications network, regardless of whether it is the only system within the building or just one of many, or even if it is located in the field

3.5
client
computer or application which requests and accepts data from a server computer or application using some kind of protocol

3.6
compatibility
capability of two or more items or components of equipment or material to exist and/or function in the same system or environment without modification, adaptation or mutual interference

3.7
data
information before it is interpreted

3.8
datagram
a self-contained unit of data transmitted independently of other datagram

3.9
data link layer
layer that manages frames and performs error detection and correction

NOTE The data link layer constitutes layer 2 of the OSI model. It can also be used to co-ordinate distribution of physical connections.

3.10
data packet
entity of data that can be sent between end-application systems in order to exchange information

NOTE A data packet relates to the application layer of the OSI stack and may be broken into several pieces by lower layer protocols.

3.11
encoding rules
rules which specify the representation during transfer of the values of ASN.1 types

NOTE Encoding rules also enable the values to be recovered from the representation, given knowledge of the type.

3.12
end-application
process or program using the communications stack

3.13
intelligent transport systems
major national initiative to improve information, communication and control technologies in order to improve the efficiency of surface transport

3.14
internet protocol
network protocol offering a connectionless mode network service in the internet suite of protocols

3.15
message
set of data grouped together for transmission

3.16
network layer
layer that provides functional and procedural means of transferring variable length data sequences from a source to a destination

NOTE The network layer constitutes layer 3 of the OSI model.

3.17
open systems interconnection
OSI
reference model developed by ISO to enable different or similar systems to dialogue with one another

NOTE 1 This model constitutes a reference framework for describing data exchanges. Each layer performs a service at the request of the adjacent higher layer, and in turn, requests more basic services from the lower layers. It is described in 7 layers.

NOTE 2 Open systems interconnection (OSI) is an international effort to facilitate communications among computers of different manufacture and technology.

3.18
physical layer
layer that defines the physical data transmission medium

NOTE The physical layer constitutes layer 1 of the OSI model.

3.19
port
logical channel in a communications system

NOTE UDP and TCP use port numbers to multiplex data packets from a variety of applications onto a single communications system.

3.20
port number
identifier of an application-entity to a transport service in the internet suite of protocols

NOTE The concept of port numbers is often present in OSI literature; however, port numbers are not inter-network standardized, but exist as local network conventions only.

3.21
presentation layer
layer that converts data using different syntax

NOTE The presentation layer constitutes layer 6 of the OSI model.

3.22
profile
standard that defines rules by only combining requirements of other standards

NOTE An application profile is a profile that specifies the application, presentation, and session layers by referencing a group of other standards.

3.23
roadside modules
terminal units controlled or monitored by a traffic management centre

NOTE Roadside modules are usually installed at the roadside arena.

3.24
server
computer or application which receives and responds to requests for data from client computers or applications using some kind of protocol

3.25
session layer
layer that manages the dialogue between end-user application processes including restart, termination, and checkpointing

NOTE The session layer constitutes layer 5 of the OSI model.

3.26
transport layer
layer that provides transparent transfer of data between end users

NOTE The transport layer constitutes layer 4 of the OSI model.

3.27
transport profile
set of services which are responsible for providing a virtually error-free, point to point connection so that host-A can send data packets to host-B and they will arrive uncorrupted

NOTE Connection-oriented transport profiles can also ensure that the data packets arrive in the correct order.

4 Abbreviated terms

AP	Application Profile
ASN.1	Abstract Syntax Notation One
ATM	Asynchronous Transfer Mode
DATEX-ASN	Data Exchange in ASN.1
FHWA	Federal Highway Administration
FDDI	Fiber Distributed Data Interface
FSK	Frequency Shift Keying
FTP	File Transfer Protocol
IEC	International Electro-technical Commission

ISO	International Organization for Standardization
OSI	Open Systems Interconnection
PICS	Profile Implementation Conformance Statement
PMPP	Point to Multi Point Protocol
PPP	Point-to-Point Protocol (RFC 1661)
SFMP	Simple Fixed Message Protocol
SLIP	Serial Line Internet Protocol
SNMP	Simple Network Management Protocol (RFC 1157)
SONET	Synchronous Optical Network
STMF	Simple Transportation Management Framework
STMP	Simple Transportation Management Protocol
TCP	Transmission Control Protocol (RFC 793)
TFTP	Trivial File Transfer Protocol
TMP	Transportation Management Protocols
TR	Technical Report
UDP	User Datagram Protocol (RFC 768)

5 General

5.1 Open systems interconnection (OSI) reference model

The OSI reference model defines seven layers, each performing a particular role in the transmission of data over a medium. Application profiles define the upper three layers.

The top layer of the OSI seven layer model, the application layer, handles issues like network transparency, resource allocation and problem partitioning. The application layer is concerned with the user's view of the network.

The second highest layer in the OSI seven layer model, also known as layer 6 or the presentation layer, performs functions such as text compression, code conversion, or format conversion to try to smooth out differences between hosts.

Layer 5, the session layer, handles security and creation of the session.

5.2 Scenario

AP-DATEX should be used when there are connections between a traffic management centre and roadside modules used for traffic management.

This part of ISO 15784 deals with the interface described in Figure 1.

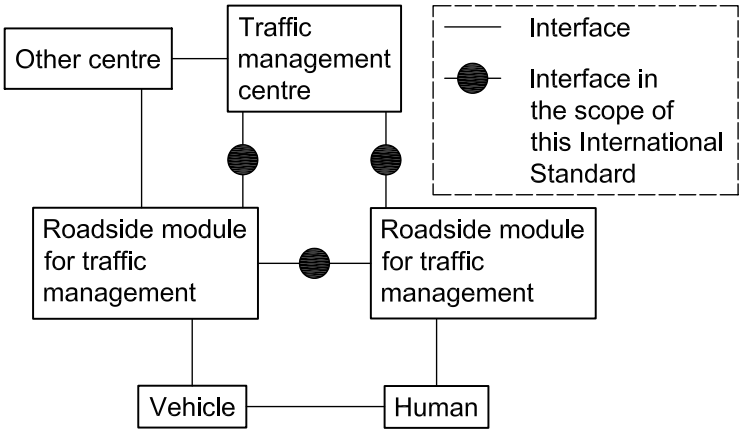

Figure 1 — Example of the ISO 15784-3 AP-scerario

The definition of application profiles and their functions and responsibilities are defined in ISO/IEC TR 10000-2:1998, 5.5.3. This profile references ISO standards for the application and presentation layers of the OSI reference model. The session layer is defined as being ⟨NULL⟩ because the selected application layer handles this functionality.

Table 1 — Relationship between OSI layer and base standard

OSI layer	Base standard	Taxonomy
Application layer	ISO 14827-2 DATEX-ASN	AP-DATEX Application profile
Presentation layer	ISO 8825-1 Basic Encoding Rules And others	
Session layer	<NULL>	

This application profile, the standard for communication between traffic management centre and roadside modules for traffic management, is suitable for usage in the following cases.

1) The intelligent roadside modules with advanced functions communicate with the centre system and each other in equal relation.

2) The exchanged data has a large size and relatively fixed structure.

3) The deteministic real time feature is not required but the efficient data exchange is required.

4) The roadside modules communicate with not only the centre system but also other roadside modules simultaneously.

Lower layer functionality such as routing, segmentation, packet error checking and byte-level transmission of data packets are addressed by transport profiles.

This application profile does not require a particular transport profile. It has been designed to work with connectionless transport profiles, but can also work with connection-oriented transport profiles.

At the application layer, Parts 1 and 2 (DATEX-ASN) of ISO 14827 are used to define the message structure and procedural rules.

The message structures defined by the application layer are defined using the ASN.1 (Abstract Syntax Notation One). ISO 14827-2 requires support of Basic Encoding Rules (BER) and allows support of additional encoding rules through a negotiation scheme. The Octet Encoding Rules (OER) is one of the options.

6 Requirements

6.1 General Requirements

6.1.1 Stack definition

The AP-DATEX is one of the application profiles defined for data exchanges between a traffic management centre and roadside modules used for traffic management. Implementations claiming conformance to this application profile shall support the following elements as stated.

a) All of the constraints defined in 6.2 to 6.4.

b) All mandatory requirements specified in A.3

c) All mandatory requirements of the standards referenced by this profile.

6.1.2 Optional features

This profile provides an identification of specific communications requirements. It also identifies optional requirements, which, under specific circumstances, are required. End-users should assume that implementations will not support optional features unless specific references to particular circumstances are made. For example, DATEX-ASN centres are not required to support online subscriptions.

6.1.3 Compatibility

AP-DATEX has compatibility with AP-TMP because the data packets of DATEX-ASN and TMP shall be identified with port numbers, or some similar scheme offered by the selected transport profile.

6.2 Application layer requirements

The application layer shall conform to ISO 14827-2:2005.

6.3 Presentation layer requirements

The implementation shall start all application layer sessions using Basic Encoding Rules (BER) when it uses the port 355, as defined in ISO 14827-2:2005. The encoding rules used to start a session when the other port is used shall be decided by off-line negotiation between server and client.

The actual encoding rules used during a session shall be dependent upon the results of the log-in negotiation process as defined by ISO 14827-2:2005. The options of encode rules for the negotiation shall be decided by off-line negotiation between server and client.

6.4 Session layer requirements

The session layer shall be ⟨NULL⟩ as these services are provided by ISO 14827-2.

6.5 Transport layer requirements

The implementation of a transport layer is defined in the Annex D of ISO 14827-2.

Annex A
(normative)

Application profile for DATEX-ASN profile requirement list

A.1 Introduction

This annex provides the profile requirements list (PRL) for implementations of the application profile for DATEX-ASN. A profile implementation conformance specification (PICS) for an implementation is generated by an implementer or supplier by indicating the appropriate level of support provided by an implementation.

To claim conformance with this profile, an implementation shall satisfy the mandatory conformance requirements of this profile.

An implementation's completed PRL is called the PICS. The PICS states which capabilities and options of the protocol have been implemented. The following can use the PICS:

a) The protocol implementer, as a checklist to reduce the risk of failure to conform to the standard through oversight.

b) The supplier and user, as a detailed indication of the capabilities of the implementation.

c) The user, as a basis for initially checking the possibility of interworking with another implementation (note that, while interworking can never be guaranteed, failure to do so can often be predicted from incompatible PICSs).

d) A user, as the basis for selecting appropriate tests against which to assess the claim for conformance of the implementation.

A.2 Global statement of conformance

The standards referenced by this profile are defined in Clause 2.

A.3 Profile requirements list (PRL)

This clause provides a PRL for implementations of this part of ISO 15784.

A.3.1 General notations

The PRL uses the following symbols to indicate the status of various features.

m	mandatory
m.<n>	support of every item of the group labeled by the same numeral <n> required, but only one is active at a time
o	optional
o.<n>	optional, but support of at least one of the group of options labeled by the same numeral <n> is required

c conditional

- non-applicable (i.e. logically impossible in the scope of the profile)

x excluded or prohibited

I out of scope of profile (left as an implementation choice)

d deprecated (listed for compatibility with older systems)

The o.<n> notation is used to show a set of selectable options (i.e., one or more of the set must be implemented) with the same identifier <n>.

Two character combinations may be used for dynamic conformance requirements. In this case, the first character refers to the static (implementation) status, and the second refers to the dynamic (use); thus “mo” means “mandatory to be implemented, optional to be used.”

A.3.2 Conditional status notation

The following notation is used to indicate conditional requirements:

<index>: This predicate symbol means that the status following it applies only when the PRL or PICS states that the features identified by the index are supported.

A.3.3 Basic requirements

Table A.1 gives the basic requirements in order to be compliant with this part of ISO 15784.

Table A.1 — Conformance requirements

Index	Topic	Base Standard		Profile		Support
		Reference	Status	Clause		
client	Does the implementation claim to be a client?	ISO 14827-2 6.3	o.1	6.2	o.1	Yes/No
server	Does the implementation claim to be a server?	ISO 14827-2 6.3	o.1	6.2	o.1	Yes/No
1	Use of a single transport profile for all data packets within a single session?	ISO 14827-2 6.1.2	m	6.2	m	Yes
port 355	Use UDP or TCP with port 355?	ISO 14827-2 D.1	o	6.5	o	Yes/No
2	Use port number 355 and BER to initiate sessions?	ISO 14827-2 D.1	port 355: m	6.5	Port 355: m	Yes/No
BER	Does the implementation support BER?	ISO 8825-1		6.3	o	Yes/No
Other-Encode	Does the implementation support other encoding rules?	ISO 14827-2 6.3.1		6.3	o	Yes/No
3	Does the system properly handle time-out negotiation?	ISO 14827-2 6.1.3	m	6.2	m	Yes
4	Does the system retransmit identical messages after a time-out occurs?	ISO 14827-2 6.1.4	m	6.2	m	Yes
5	Does the system respond to a duplicate data packet with a newly created response data packet?	ISO 14827-2 6.1.5	m	6.2	m	Yes
files	Does the system support file transfer?	ISO 14827-2 6.2	o	6.2	o	Yes/No

Table A.1 — Conformance requirements (*continued*)

Index	Topic	Base Standard		Profile		Support
		Reference	Status	Clause		
ftp	Does the system support the FTP protocol?	ISO 14827-2 6.2	files: o.2	6.2	files: o.2	Yes/No/ NA
tftp	Does the System support the TFTP protocol?	ISO 14827-2 6.2	files: o.2	6.2	files: o.2	Yes/No/ NA
6	Does the file contain the publication data structure and nothing else?	ISO 14827-2 6.2	files: m	6.2	files: m	Yes/No
dial-up	Does the implementation claim support switched connections?	ISO 14827-2 6.4	o	6.2	o	Yes/No

A.3.4 Server requirements

Table A.2 — Status of the various features for servers

Index	Topic	Base Standard		Profile		Support
		Reference	Status	Clause		
7	Does the server reject a login request from client domain name with an existing session on the same transport profile?	ISO 14827-2 6.3	m	6.2	m	Yes
8	Is the server able to generate initiate request?	ISO 14827-2 6.3.1	dial-up: m	6.2	dial-up: m	Yes/No
9	Does the server accept a valid login request from a new client?	ISO 14827-2 6.3.1	m	6.2	m	Yes
10	Does the server respond to a valid login with an accept message?	ISO 14827-2 6.3.1	m	6.2	m	Yes
11	Does the server reject an invalid login request?	ISO 14827-2 6.3.1	m	6.2	m	Yes
11.1	Does the server reject a login by transmitting a reject data packet?	ISO 14827-2 6.3.1	o.3	6.2	o.3	Yes/No/ NA
11.2	Does the server silently reject an invalid login?	ISO 14827-2 6.3.1	o.3	6.2	o.3	Yes/No/ NA
12	Does the server transmit a FrED response to a FrED with the confirm message number set to zero (0)?	ISO 14827-2 6.3.2	m	6.2	m	Yes
13	Does the server terminate a session when no messages are received for a period exceeding the maximum heartbeat duration?	ISO 14827-2 6.3.2	m	6.2	m	Yes
14	Can the server transmit a terminate data packet?	ISO 14827-2 6.3.3	m	6.2	m	Yes
15	Does the server properly support the reception of a logout data packet?	ISO 14827-2 6.3.3	m	6.2	m	Yes
15.1	Does the server issue a FrED response to a valid logout data packet?	ISO 14827-2 6.3.3	m	6.2	m	Yes
15.2	Does the server terminate the session after receiving a valid logout?	ISO 14827-2 6.3.3	m	6.2	m	Yes

Table A.2 — Status of the various features for servers (*continued*)

Index	Topic	Base Standard		Profile		Support
		Reference	Status	Clause		
16	Does the server provide for off-line subscriptions for all subscriptions?	ISO 14827-2 6.4.1	o.4	6.2	o.4	Yes/No/ NA
server-on-line	Does the server support on-line subscriptions?	ISO 14827-2 6.4.2	o.4	6.2	o.4	Yes/No/ NA
17	Does the server support on-line subscriptions for all subscriptions it supports?	ISO 14827-2 6.4.2	server-on-line: m	6.2	server-on-line: m	Yes/No
18	Does the server accept subscription data packets?	ISO 14827-2 6.4.2	server-on-line: m	6.2	server-on-line: m	Yes/No
19	Does the server properly respond to subscription data packets?	ISO 14827-2 6.4.2	server-on-line: m	6.2	server-on-line: m	Yes/No
19.1	Does the server transmit an accept data packet for valid subscriptions?	ISO 14827-2 6.4.2	server-on-line: m	6.2	server-on-line: m	Yes/No
19.2	Does the server transmit a reject data packet for an invalid subscription?	ISO 14827-2 6.4.2	server-on-line: m	6.2	server-on-line: m	Yes/No
19.3	Does the server allow for a cancel subscription?	ISO 14827-2 6.4.2	server-on-line: m	6.2	server-on-line: m	Yes/No
19.4	Does the server support single subscriptions?	ISO 14827-2 6.5.2	m	6.2	m	Yes
19.5	Does the server support registered periodic subscriptions?	ISO 14827-2 6.5.3	m	6.2	m	Yes
19.6	Does the server support registered on-occurrence subscriptions?	ISO 14827-2 6.5.3	m	6.2	m	Yes
20	Can the server publish publications for all subscriptions for which it claims support?	ISO 14827-2 6.5	m	6.2	m	Yes
21	Does the server support any subscriptions which require file publications?	ISO 14827-2 6.5	o	6.2	o	Yes/No
22	Does the server support the transmission of multiple publications within a single file/data packet?	ISO 14827-2 6.5	o	6.2	o	Yes/No
23	Does the server retransmit the publication if an accept or reject data packet is not received within the time-out period when the guarantee flag is set to true?	ISO 14827-2 6.1.4	m	6.2	m	Yes
24	Does the server accept the transfer-done data packet as a notice that it may delete the subject file?	ISO 14827-2 6.5.1.5	m	6.2	m	Yes
25	Does the server respond to a transfer done data packet with FrED data packet?	ISO 14827-2 6.5.1.5	m	6.2	m	Yes
26	Can the server terminate a subscription through a publication?	ISO 14827-2 6.5.1.5	m	6.2	m	Yes