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Intelligent transport systems — Dedicated short range communication (DSRC) — DSRC application layer

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National foreword

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Intelligent transport systems — Dedicated short range communication (DSRC) — DSRC application layer

Systèmes intelligents de transport — Communications spécialisées à courte portée (DSRC) — Couche d'application DSRC

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Contents

Page

Foreword ..... **iv**
Introduction ..... **v**
1 Scope **1**
2 Normative references **2**
3 Terms and definitions **2**
4 Abbreviations **4**
5 Structure of the application layer core **6**
6 Transfer kernel **7**
6.1 General 7
6.2 Services 8
7 Initialisation kernel **21**
7.1 General 21
7.2 Services 21
7.3 Behaviour 24
8 Broadcast kernel **27**
8.1 General 27
8.2 Services 27
8.3 Behaviour 28
9 Extensibility for different lower layer services and application interfaces **29**
9.1 General 29
9.2 Extended definitions 30
Annex A (normative) **Data structures** **34**
Annex B (normative) **Naming and registration** **40**
Annex C (informative) **Example of coding** **41**
Annex D (normative) **Declaration of application layer features supported** **44**
Annex E (informative) **Lower layer services** **45**
Bibliography **49**

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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

ISO 15628 was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*.

This second edition cancels and replaces the first edition (ISO 15628:2007), which has been technically revised.

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Introduction

The communication requirements of many ITS applications can be fulfilled by DSRC. The DSRC International Standards enable compliant communication systems to serve multiple ITS applications in parallel.

The small service areas and severe real-time constraints require a specific protocol architecture leading to the reduced protocol stack shown in Figure 1, built up by the "application layer", the "data link layer" and the "physical layer". Such architecture is very common for real-time environments.

This International Standard gives the architecture and services offered by the DSRC application layer.

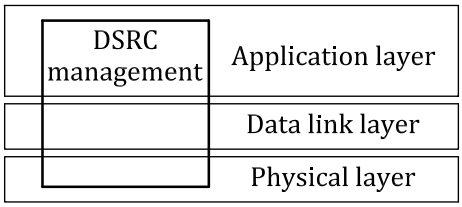

Figure 1 — DSRC protocol stack

This International Standard contains, besides the normative main body, three normative annexes: "Data structures", "Naming and registration", "Declaration of application layer features supported"; plus two informative annexes: "Example of coding" and "Lower layer services".

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Intelligent transport systems — Dedicated short range communication (DSRC) — DSRC application layer

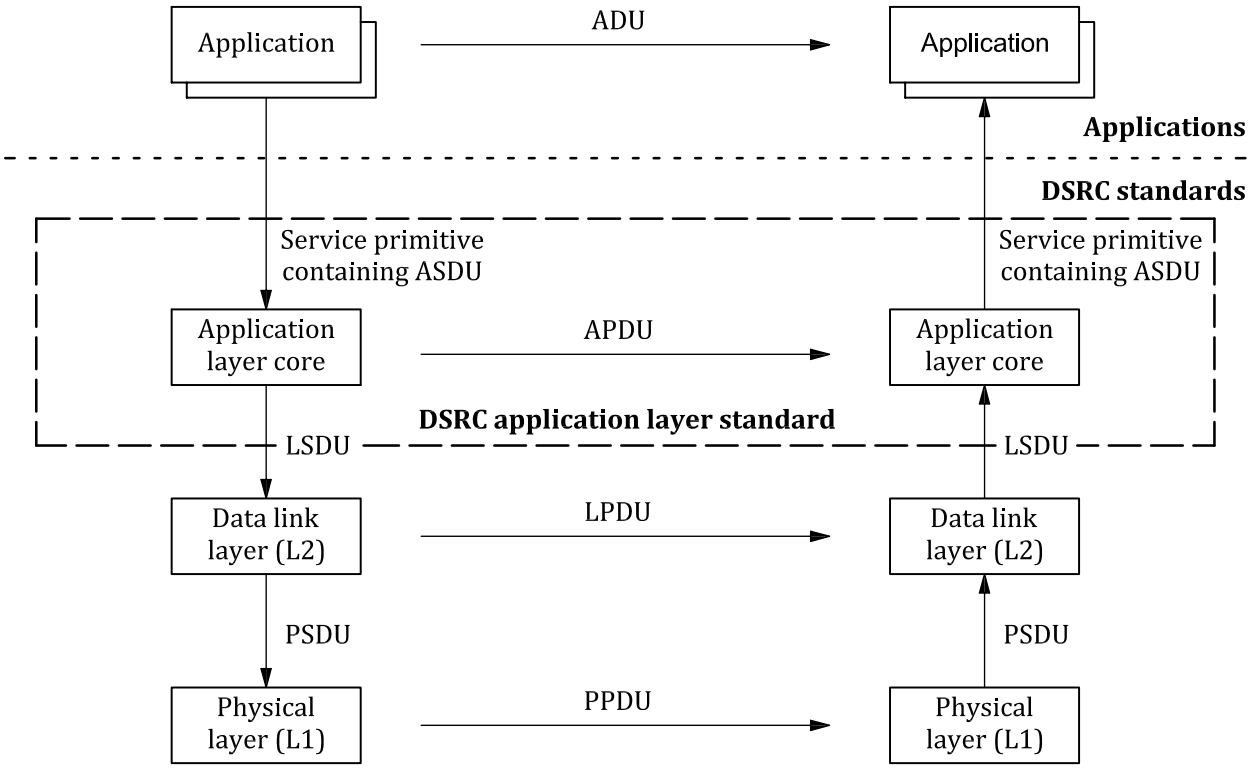
1 Scope

This International Standard specifies the application layer core which provides communication tools for applications based on DSRC. These tools consist of kernels that can be used by application processes via service primitives. The application processes, including application data and application-specific functions, are outside the scope of this International Standard.

This International Standard is named "application layer", although it does not cover all functionality of OSI Layer 7 and it includes functionality from lower layers.

It uses services provided by DSRC data link layer, and covers functionality of intermediate layers of the "OSI Basic Reference Model" (ISO/IEC 7498-1).

Figure 2 illustrates the global data flow between the parts of the DSRC stack (physical, data link and application layers) and the application.



NOTE For definitions of the terms used in Figure 2, see ISO/IEC 7498-1.

Figure 2 — Architecture and data flow of the DSRC stack

The following subjects are covered by this International Standard:

— application layer structure and framework;

— services to enable data transfer and remote operations;

— application multiplexing procedure;

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— fragmentation procedure;

— concatenation and chaining procedures;

— common encoding rules to translate data from abstract syntax ASN.1 (ISO/IEC 8824-1) into transfer syntax (ISO/IEC 8825-2:2008) and vice versa;

— communication initialisation and release procedures;

— broadcast service support;

— DSRC management support including communication profile handling; and

— extensibility for different lower layer services and application interfaces.

It is outside the scope of this International Standard to define a security policy. Some transport mechanisms for security-related data are provided.

NOTE No implementation of the "broadcast pool" functionality has become known. "Broadcast pool" functionality is therefore considered untested.

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 8825-2:2008, *Information technology — ASN.1 encoding rules: Specification of Packed Encoding Rules (PER)*

3 Terms and definitions

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

3.1
application
user of the services offered by the DSRC communication stack

3.2
attribute
value, which may have a structure, consisting of a set or sequence of data elements

Note 1 to entry: The value of an "attribute" can be observed or modified by sending a request to GET (read) or SET (write) the value.

3.3
attribute identifier
identifier which unambiguously distinguishes an attribute from all other attributes within the same element

3.4
beacon service table
data structure transmitted by the RSU indicating available services

3.5
broadcast pool
data structure broadcast from the RSU to the OBUs

3.6
chaining
function performed by the transfer kernel to link the execution of service primitives

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3.7
concatenation
function performed by the transfer kernel to map multiple T-APDU fragments into one data link layer service data unit

Note 1 to entry: The inverse function is called separation or deconcatenation.

3.8
element
coherent set of data and functionality

Note 1 to entry: Application elements are created by the applications and are addressed using element identifiers.

3.9
element identifier
identifier which unambiguously distinguishes an element from all other elements residing in the same OBU

3.10
fragmentation
function performed by the transfer kernel to map one ASDU on multiple LSDUs

Note 1 to entry: In ISO/IEC 7498-1, fragmentation is called segmentation.

Note 2 to entry: The inverse function is called defragmentation or, in ISO/IEC 7498-1, disassembling.

3.11
head of the line
queuing discipline (also referred to as strict or fixed priority queuing), where a number of queues are served in priority order

Note 1 to entry: A lower priority queue is served if all higher priority queues are empty, each queue is served in "first come, first served" order, and each user goes to the head of the line of the users of lower priorities but behind all users of equal or higher priority.

3.12
management
provides and distributes values for the communication parameters for controlling the DSRC communication stack

3.13
multiplexing
function within the transfer kernel allowing simultaneous support for more than one application in a single OBU

3.14
operation
abstract representation of behaviour invoked in an entity

3.15
profile
information about capabilities and settings in the different DSRC layers

3.16
single-T-APDU fragment
T-APDU that contains a complete PDU

3.17
T-APDU fragment
fragment header followed by part or all of the encoding of a value of the ASN.1 type T-APDUs

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3.18
time
number of seconds passed since 1st January 1970, 00:00 (UTC)

3.19
vehicle service table
data structure transmitted by the OBU indicating available services

4 Abbreviations

For the purposes of this document, the following abbreviations apply.

4.1
ADU
application data unit

4.2
AID
application identifier

4.3
APDU
application protocol data unit

4.4
ARIB
Association of Radio Industries and Businesses

4.5
ASDU
application service data unit

4.6
ASN.1
abstract syntax notation one (ISO/IEC 8824-1)

4.7
ASTM
American Society of Testing and Materials

4.8
B-Kernel
broadcast kernel

4.9
BST
beacon service table

4.10
CEN
Comité européen de normalisation

4.11
DSRC
dedicated short range communication

4.12
EID
element identifier

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4.13
EVENT-RT
event-report

4.14
FCS
frame check sequence

4.15
ID
identifier

4.16
IEEE
Institute of Electrical and Electronic Engineers

4.17
IID
invoker identifier

4.18
I-Kernel
initialisation kernel

4.19
LID
logical link control identifier

4.20
LLC
logical link control

4.21
LPDU
LLC protocol data unit

4.22
LSDU
LLC service data unit

4.23
L1
layer 1 of DSRC (physical layer)

4.24
L2
layer 2 of DSRC (data link layer)

4.25
L7
application layer core of DSRC

4.26
MAC
medium access control

4.27
NEN
Nederlands Normalisatie-instituut

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4.28
OBU
on-board unit

Note 1 to entry: This equipment usually resides on board a vehicle.

4.29
PDU
protocol data unit

4.30
PPDU
physical layer protocol data unit

4.31
PSDU
physical layer service data unit

4.32
PER
packed encoding rules (ISO/IEC 8825-2:2008)

4.33
RSU
road-side unit

Note 1 to entry: This is often referred to as beacon.

4.34
RTTT
road transport and traffic telematics

4.35
SDU
service data unit

4.36
T-APDU
transfer application protocol data unit

4.37
T-Kernel
transfer kernel

4.38
VST
vehicle service table

5 Structure of the application layer core

The "application layer core" shall consist of the T-Kernel and either the I-Kernel or the B-Kernel, or both.

Figure 3 shows the application layer kernels and the relationships to external entities. The T-Kernel provides the basic transportation facilities that can be used by the I-Kernel, by the B-Kernel and by the applications.

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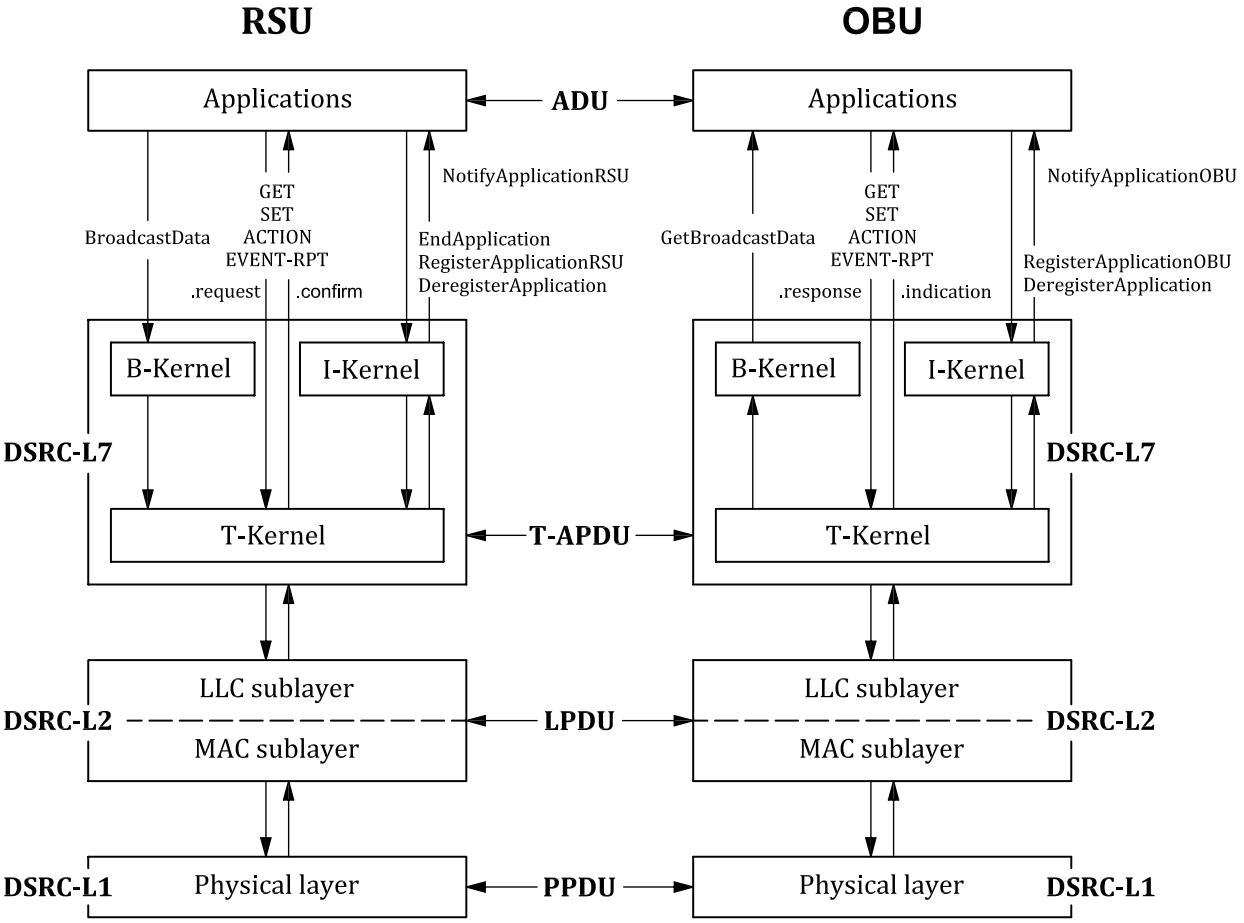

Figure 3 — Context and structure of the application layer core

6 Transfer kernel

6.1 General

The T-Kernel shall transfer information between two peer kernels or applications, and shall abstract from the realization of this transfer.

The T-Kernel shall offer its services by means of service primitives defined in 6.2.2.

The T-Kernel shall transfer the information by means of T-APDUs defined in Annex A.

The T-Kernel shall realize the transfer by means of a protocol with the behaviour defined in 6.2.5.

The T-Kernel shall use the services of the logical link control sub-layer of the DSRC data link layer, which is defined in Clause 9 and Annex E.

NOTE The behaviour defined in 6.2.5 does not guarantee that the service elements with the same priorities will be delivered to a receiving application in the same order as they were delivered to the T-Kernel on the sending side.

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6.2 Services

6.2.1 General

The T-Kernel shall provide the following services:

— GET: The invocation of the "GET" service by an application shall result in the retrieval (reading) of information (i.e. attributes) from a peer application. The service shall only be requested in a confirmed mode, and a reply is expected.

— SET: The invocation of the "SET" service by an application shall result in the modification (writing) of information (i.e. attributes) by a peer application. The service may be requested in confirmed or non-confirmed mode. In confirmed mode, a reply is expected.

— ACTION: The invocation of the "ACTION" service by an application shall result in the performance of an action by a peer application. An action is further qualified by the value of the "ActionType" (see ISO 14906 for examples). The service may be requested in confirmed or non-confirmed mode. In confirmed mode, a reply is expected.

— EVENT-REPORT: The invocation of the "EVENT-REPORT" service by an application or by the I-Kernel shall result in the notification of an event to a peer application or I-Kernel. The service may be requested in confirmed or non-confirmed mode. In confirmed mode, a reply is expected.

— INITIALISATION: The invocation of the "INITIALISATION" service by the I-Kernel shall result in an attempt to initialise the communication between an RSU and each OBU that has not yet established communication with that RSU. The "INITIALISATION" service shall only be used by the I-Kernel.

6.2.2 Service primitives

The T-Kernel shall provide the services given in 6.2.1 by the following service primitives:

— GET.request;

— GET.indication;

— GET.response;

— GET.confirm;

— SET.request;

— SET.indication;

— SET.response;

— SET.confirm;

— ACTION.request;

— ACTION.indication;

— ACTION.response;

— ACTION.confirm;

— EVENT-REPORT.request;

— EVENT-REPORT.indication;

— EVENT-REPORT.response;

— EVENT-REPORT.confirm:

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— INITIALISATION.request;

— INITIALISATION.indication;

— INITIALISATION.response;

— INITIALISATION.confirm.

The INITIALISATION.request and INITIALISATION.confirm primitives shall only be used on the RSU side, the INITIALISATION.indication and INITIALISATION.response primitives shall only be used on OBU side.

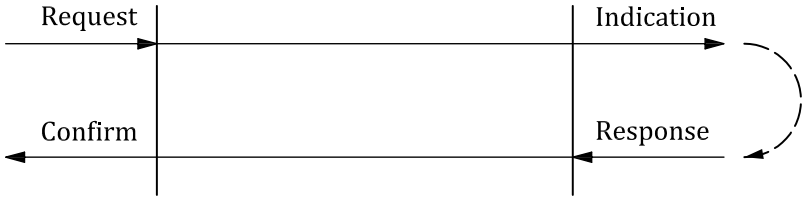

Figure 4 — Services used in confirmed mode

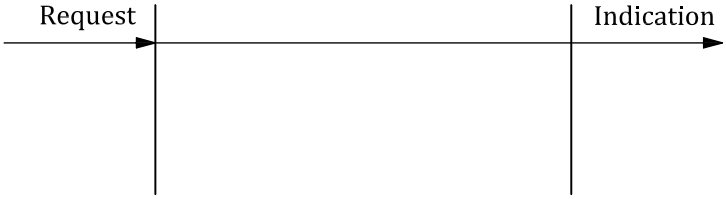

Figure 5 — Services used in non-confirmed mode

6.2.3 Format of service primitives

The T-ASDUs for the service primitives shall have the formats defined in Tables 2 to 6, with the notation defined in Table 1.

Table 1 — Definition of the expressions used in Tables 2 to 5

Symbol	Definition
iid/eid	Mandatory. IID of related indication if present, else EID of related indication.
optional	The use of the optional fields is detailed by the underlying ASN.1 standards.
=	Same as in corresponding request/indication.
—	Not applicable.

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Table 2 — Format of the GET service primitives

Parameter name	Request/indication	Response	Confirm	ASN.1 type
Invoker identifier (IID)	optional	=		Dsrc-EID
Link identifier (LID)	mandatory	=		BIT STRING
Chaining	mandatory	=		Boolean
Element identifier (EID)	mandatory	iid/eid		Dsrc-EID
Access credentials	optional	—		OCTET STRING
Attribute Id list (AttrIdList)	optional	—		AttributeIdList
FlowControl	mandatory	mandatory	optional	INTEGER
Attribute list (AttrList)	—	optional		AttributeList
Return code (Ret)	—	optional		ReturnStatus

Table 3 — Format of the SET service primitives

Parameter name	Request/indication	Response	Confirm	ASN.1 type
Invoker identifier (IID)	optional	=		Dsrc-EID
Link identifier (LID)	mandatory	=		BIT STRING
Chaining	mandatory	=		Boolean
Element identifier (EID)	mandatory	iid/eid		Dsrc-EID
Access credentials	optional	—		OCTET STRING
Attribute list (AttrList)	mandatory	—		AttributeList
Mode	mandatory	—		Boolean
FlowControl	mandatory	mandatory	optional	INTEGER
Return code (Ret)	—	optional		ReturnStatus

Table 4 — Format of the ACTION service primitives

Parameter name	Request/indication	Response	Confirm	ASN.1 type
Invoker identifier (IID)	optional	=		Dsrc-EID
Link identifier (LID)	mandatory	=		BIT STRING
Chaining	mandatory	=		Boolean
Element identifier (EID)	mandatory	iid/eid		Dsrc-EID
ActionType	mandatory	—		INTEGER(0..127,..)
Access credentials	optional	—		OCTET STRING
ActionParameter	optional	—		Container
Mode	mandatory	—		Boolean
FlowControl	mandatory	mandatory	optional	INTEGER
ResponseParameter	—	optional		Container
Return code (Ret)	—	optional		ReturnStatus

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