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Road vehicles — Unified diagnostic services (UDS) —

Part 5: Unified diagnostic services on Internet Protocol implementation (UDSonIP)

Véhicules routiers — Services de diagnostic unifiés (SDU) —

Partie 5: SDU sur l'implémentation du protocole internet (SDUsurIP)

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 31, *Data communication*.

This second edition cancels and replaces the first edition (ISO 14229-5:2013), which has been technically revised.

The main changes are as follows:

— restructuration of the document;

— introduction of requirement numbers, names and definitions;

— technical content improvements based on implementation feedback from the automotive industry.

A list of all parts in the ISO 14229 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The ISO 14229 series has been established in order to define common requirements for diagnostic systems, whatever the serial data link is.

To achieve this, the ISO 14229 series is based on the Open Systems Interconnection (OSI) Basic Reference Model in accordance with ISO/IEC 7498-1[1] and ISO/IEC 10731[2], which structures communication systems into seven layers. When mapped on this model, the services used by a diagnostic tester (client) and an electronic control unit (ECU, server) are structured into the following layers:

— application layer (layer 7) specified in ISO 14229-1 and ISO 14229-3 to ISO 14229-8;

— presentation layer (layer 6) specified in ISO 14229-1 and ISO 14229-3 to ISO 14229-8;

— session layer services (layer 5) specified in ISO 14229-2 and ISO 14229-3 to ISO 14229-8.

Figure 1 illustrates the UDSonIP document and related documents according to the OSI model.

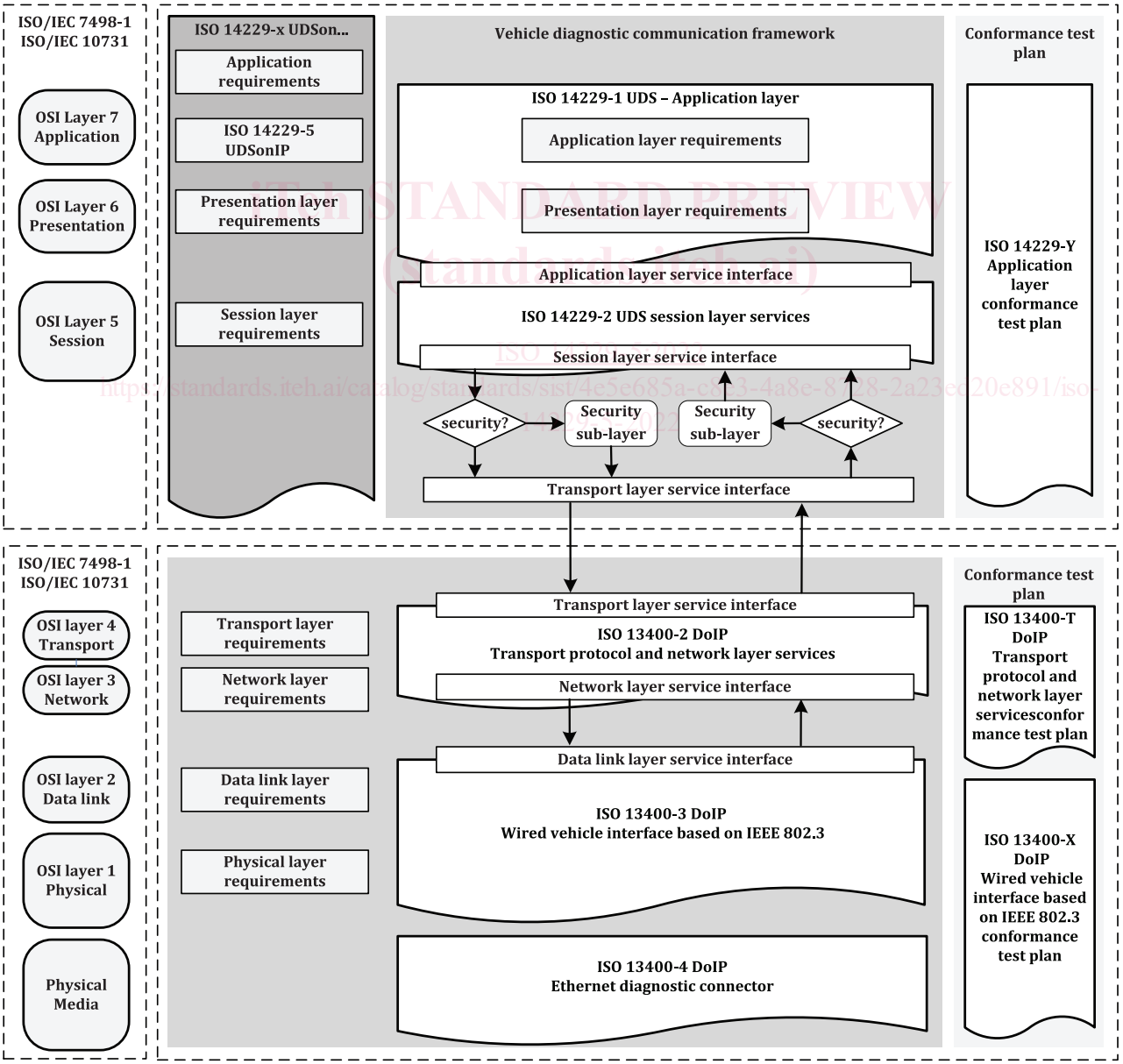


Figure 1 — UDSonIP document reference according to OSI model

Road vehicles — Unified diagnostic services (UDS) —

Part 5: Unified diagnostic services on Internet Protocol implementation (UDSonIP)

1 Scope

This document specifies an application profile for the implementation of unified diagnostic services (UDS) Internet Protocol (IP) in road vehicles (UDSonIP).

UDSonIP references ISO 14229-1 and ISO 14229-2 and specifies implementation requirements of the diagnostic services to be used for diagnostic communication on Internet Protocol.

This document includes

— additional requirements specific to the implementation of UDS on the Ethernet network, and

— specific restrictions in the implementation of UDS on the Ethernet network.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 13400-2, *Road vehicles — Diagnostic communication over Internet Protocol (DoIP) — Part 2: Transport protocol and network layer services*

ISO 13400-3, *Road vehicles — Diagnostic communication over Internet Protocol (DoIP) — Part 3: Wired vehicle interface based on IEEE 802.3*

ISO 14229-1, *Road vehicles — Unified diagnostic services (UDS) — Part 1: Application layer*

ISO 14229-2, *Road vehicles — Unified diagnostic services (UDS) — Part 2: Session layer services*

IETF RFC 793:1981, *Transmission Control Protocol — DARPA Internet Program — Protocol Specification*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 14229-1 and ISO 14229-2 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Symbols and abbreviated terms

4.1 Symbols

—	empty table cell or feature undefined
t	time
t_{P_Client}	client application layer timer
t_{P2_Server}	server application layer timer
t_{S3_Client}	client session layer timer
t_{S3_Server}	server session layer timer
$t_{S3\_Server\_Reload}$	server session layer timeout value-reload
$t_{P6\_DoIP\_Client}$	client application layer timeout value for DoIP

4.2 Abbreviated terms

DID	data identifier
DoIP	diagnostic communication over Internet Protocol
DoIP_AI	DoIP address information
DoIP_SA	DoIP source address
DoIP_TA	DoIP target address
DoIP_TAtype	DoIP target address type
GH_PT	generic header payload type
GH_PL	generic header payload length
IP	Internet Protocol
OSI	Open System Interconnection
pDID	periodic data identifier
UDS	unified diagnostic services
VM	vehicle manufacturer

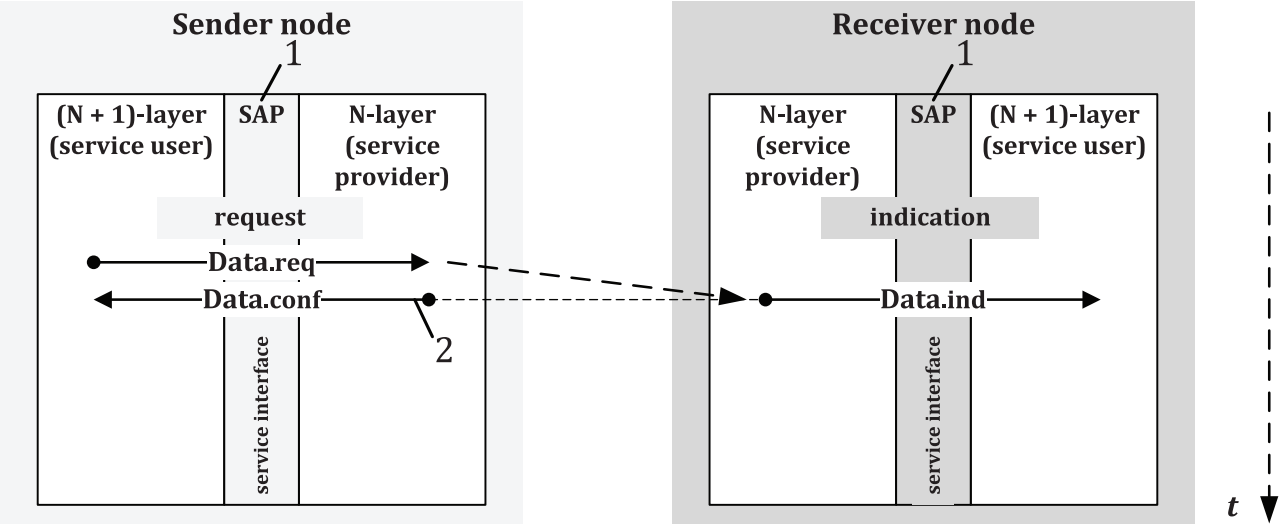
5 Conventions

This document is based on OSI service conventions as specified in ISO/IEC 10731[2].

6 Service primitive interface definition

The service interface defines the service and parameter mapping from the application layer to the session layer.

Figure 2 shows the Data.req (request), Data.ind (indication), and Data.conf (confirmation) service interface.



Key

1 service access point between application and application layer

2 read back from N-layer service provider

t time

Figure 2 — Data.req, Data.ind, and Data.conf service interface

7 Technical requirements overview

Table 1 provides an overview on the technical requirements and their associated requirement number.

Table 1 — Technical requirements overview

OSI#.REQ#	Technical requirement title
7	**Application layer**
7.1	ISO 14229-1 service primitive parameters
7.2	A_Data.req, A_Data.ind, and A_Data.conf service interface
7.3	UDSonIP-specific requirements
7.4	No UDSonIP-specific requirements
7.5	Generic DoIP header of A_PDU
7.6	A_PDU for UDS request and response message
7.7	A_PDU for UDS periodic response message
7.8	DiagnosticSessionControl – TCP connection handling
7.9	DiagnosticSessionControl – TCP connection closing
7.10	ECUReset – TCP connection handling
7.11	ECUReset – TCP connection closing
7.12	ReadDataByPeriodicIdentifier – A_Data.req
7.13	ReadDataByPeriodicIdentifier – A_Data.ind
7.14	ReadDataByPeriodicIdentifier – A_Data.conf
7.15	ReadDataByPeriodicIdentifier – Service primitive parameters
7.16	ReadDataByPeriodicIdentifier – Periodic response A_PDU format
7.17	ReadDataByPeriodicIdentifier – Periodic transmission response message handling
7.18	ReadDataByPeriodicIdentifier – Periodic transmission response message server restrictions

Table 1 *(continued)*

OSI#.REQ#	Technical requirement title
7.19	Timing parameter definition
7.20	Unsolicited response messages
6	**Presentation layer**
	No requirement statement in this document
5	**Session layer**
5.1	Service primitive parameter definition
5.2	S_Data.req, S_Data.ind, and S_Data.conf service interface
4	**Transport layer**
4.1	Service primitive parameter definition
4.2	T_Data.req, T_Data.ind, and T_Data.conf service interface
4.3	Mapping of data link-independent service primitives onto IP data link-dependent service primitives
4.4	Mapping of T_PDU onto DoIP_PDU
3	**Network layer**
3.1	Service primitive parameter definition
3.2	DoIP_Data.req, DoIP_Data.ind, and DoIP_Data.conf service interface
3.3	Logical address information
2	**Data link layer**
2.1	Service primitive parameter definition
2.2	L_Data.req, L_Data.ind, and L_Data.conf service interface
1	**Physical layer**
	No requirement statement in this document

8 Application layer

8.1 ISO 14229-1 service primitive parameters

This document is part of the ISO 14229 series and therefore, the service primitive parameter implementation follows the ISO 14229-1 specification.

REQ	7.1 UDSonIP – ISO 14229-1 service primitive parameters
The service primitive parameter shall be implemented as specified in ISO 14229-1.	

8.2 A_Data.req, A_Data.ind, and A_Data.conf service interface

This document is part of the ISO 14229 series and therefore, the service interface implementation follows the ISO 14229-1 specification.

REQ	7.2 UDSonIP – `A_Data.req`, `A_Data.ind`, and `A_Data.conf` service interface
The `A_Data.req`, `A_Data.ind`, and `A_Data.conf` service interface shall be implemented as specified in ISO 14229-1.	

8.3 UDSonIP services overview

The purpose of Table 2 is to reference all ISO 14229-1 and ISO 14229-2 services as they are applicable for an implementation in this document. Table 2 contains the UDSonIP diagnostic services. Certain UDSonIP applications can restrict the number of useable services and can categorize them in application areas/diagnostic sessions (default session, programming session, etc.).

REQ	7.3 UDSonIP – UDSonIP-specific requirements
Services that are marked “UDSonIP-specific requirements” shall be implemented as specified in the referenced subclause number in accordance with Table 2 "Reference" column.	

REQ	7.4 UDSonIP – No UDSonIP-specific requirements
Services specified in Table 2 that are marked “No UDSonIP-specific requirements” shall be implemented as specified in ISO 14229-1 and ISO 14229-2 with no additional restrictions.	

Table 2 — Overview of applicable ISO 14229-1-defined services

Functional unit name	Diagnostic service name	Comment	Reference
Diagnostic and communication management	DiagnosticSessionControl	UDSonP-specific requirements	see 8.5
	ECUReset	UDSonP-specific requirements	see 8.6
	SecurityAccess	No UDSonP-specific requirements	—
	CommunicationControl	No UDSonP-specific requirements	—
	TesterPresent	No UDSonP-specific requirements	—
	Authentication	No UDSonP-specific requirements	—
	SecuredDataTransmission	No UDSonP-specific requirements	—
	ControlDTCSetting	No UDSonP-specific requirements	—
	ResponseOnEvent	UDSonP-specific requirements	see 8.8
	LinkControl	No UDSonP-specific requirements	—
Data transmission	ReadDataByIdentifier	No UDSonP-specific requirements	—
	ReadMemoryByAddress	No UDSonP-specific requirements	—
	ReadScalingDataByIdentifier	No UDSonP-specific requirements	—
	ReadDataByPeriodicIdentifier	UDSonP-specific requirements	see 8.7
	DynamicallyDefineDataIdentifier	No UDSonP-specific requirements	—
	WriteDataByIdentifier	No UDSonP-specific requirements	—
	WriteMemoryByAddress	No UDSonP-specific requirements	—
Stored data transmission	ReadDTCInformation	No UDSonP-specific requirements	—
	ClearDiagnosticInformation	No UDSonP-specific requirements	—
Input/output control	InputOutputControlByIdentifier	No UDSonP-specific requirements	—
Remote activation of routine	RoutineControl	No UDSonP-specific requirements	—
Upload/ download	RequestDownload	No UDSonP-specific requirements	—
	RequestUpload	No UDSonP-specific requirements	—
	TransferData	No UDSonP-specific requirements	—
	RequestTransferExit	No UDSonP-specific requirements	—
	RequestFileTransfer	No UDSonP-specific requirements	—

8.4 A_PDU definition

8.4.1 Generic DoIP header of A_PDU

REQ	7.5 UDSonIP – Generic DoIP header of A_PDU
The A_PDU definition includes the generic DoIP header which shall be followed according to ISO 13400-2.	

8.4.2 A_PDU for UDS request and response message

The A_PDU of UDSonIP implements an ISO 13400-2 generic DoIP header and payload for UDS request and response messages.

REQ	7.6 UDSonIP – A_PDU for UDS request and response message
Figure 3 specifies the UDSonIP A_PDU for UDS request and response message in accordance with ISO 13400-2, which shall be followed for all UDSonIP messages.	

Figure 3 shows the A_PDU which consists of:

— protocol version;

— payload type: 8001_{16}, diagnostic message (request/response);

— payload length;

— logical source and target address;

— ISO 14229-1 service identifier;

— ISO 14229-1 data.

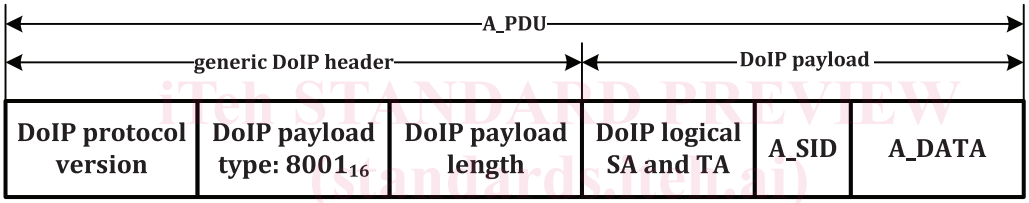


Figure 3 — A_PDU for UDS request and response message

8.4.3 A_PDU for UDS periodic response message

Periodic response messages are differentiated from non-periodic response messages with a specific DoIP payload type.

REQ	7.7 UDSonIP – A_PDU for UDS periodic response message
Figure 4 specifies the UDSonIP A_PDU for UDS periodic response message in accordance with ISO 13400-2, which shall be followed for all UDSonIP messages.	

Figure 4 shows the A_PDU which consists of:

— protocol version;

— payload type: 8004_{16}, diagnostic message (periodic response);

— payload length;

— logical source and target address;

— ISO 14229-1 periodic data identifier;

— ISO 14229-1 periodic data.